ASCORBIC ACID AND ITS USES (VITAMIN C)

A SELECT ANNOTATED BIBLIOGRAPHY

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DEDICATED TO THE LASTING
MEMORY OF MY SISTER
FARHANA KHATOON

C O N T E N T S

Acknowledgement i

Aim Scope and Methodology iii

Literature Consulted vi

PART ONE

INTRODUCTION

Ascorbic Acid - History 1

Chemistry and analytical determination 2

Source of Vitamin C- Absorption, Distribution, Elimination 4

Metabolism 10

Biochemical and Physiologic Functions 11

Extrascorbutic and Pharmacodynamic Functions 17

Marginal Vitamin C-Deficiency 21

Impact of marginal Vitamin C deficiency on health 28

Vitamin C deficiency in man 30

Daily requirements 33

Safety of Vitamin C 36

PART TWO

Annotated Bibliography 39

PART THREE

Appendices

Appendix A - Symbols and Abbreviations 189

Appendix B - Author, Subject and Title Index 193

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At this juncture how can I forget **Mr. H.K. Sharma** for typing the manuscript at a very short notice.

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(MOHD. TAMHID AHMAD)

AIM SCOPE AND METHODOLOGY

As a consequence of the disastrous vovage around the world from 1740 to 1744. When Adniral Geogge A. Anson lost most of his men, most due to scurvy. James Lind in 1742 performed his famous experiment, which may have been the first controlled clinical trial. He published his findings in his "Treatise of the Scurvy", described the disease as a dietry deficiency, and demonstrated that patients given lemon juice recovered. Still, scurvy incidents continued to occur periodically even though prevention had been demonstrated particularly during wars poor nutrition caused the disease.

For the past several years efforts have been made to develop methods to use ascorbic acid for medicinal purposes. There is need to intensify this effort, particularly at this juncture, when all out effort is being made to attain self-sufficiency. However, like all emerging research areas, papers published in these areas are scattered and retrieval is difficult. Here an attempt is made to collect all published papers and compiled bibliography which will be very useful for the researchers of our country.

I was given the task of preparing an annotated bibliography of 250 articles on "Ascorbic acid and its uses (Vitamine C)", as it was supposed that it might be of great use to the research scholars in this field.

The material was collected in the Seminar libraries of the Department of Chemistry, Botany, Zoology, Medical

College library and Maulana Azad Library, A.M.U. Aligarh.

STANDARD FOLLOWED :

As far as possible the International standard has been followed. After searching the literature entries were recorded on catalogue cards of 20 x 12 cm. size. The entries in the bibliography contains abstracts giving essential information about the articles. Each entry has been given a subject Heading.

ARRANGEMENT :

The bibliography is in three parts. Part one deals History, Sources of Vitamin C, Absorption, Distribution, on health, daily requirements of Ascorbic acid.

Part two deals with bibliography. Entries in bibliographical part have been arranged alphabetical according to their subject. Each bibliographical entry contains the following items of information.

a) Serial Number
b) Name of author/authors (a semicolon (;) in between the authors)
c) A full stop (.)
d) Title of the article including subtitle
e) Title of periodical publication
f) A full stop (.)
g) Year of periodical publication
h) A comma (,)
i) Volume Number

j) Issue number in bracket.

k) A comma (,)

l) Inclusive pages of the article

Specimen Entry is given below.

225. STORAGE-CHANGES, SBUSTANTIAL-INFLUENCE

Asker, A.F.; Harris, C.W. Influence of storage under tropical conditions on the stability and dissolution of ascorbic acid tablets. Drug. Dev. Ind. Pharm. 1990, 16(1), 165-74.

Ascorbic acid tablets stored at 40° and 90% relative humidity (R.H.) demonstrated substantial changes in chem. as well as phys. stability including color, disintegration, time, hardness and dissoln. rate. Tablets stored at 40° and 35% R.H. showed virtually no change in chem. stability and hardness but measurable changes in disintegration time and dissoln. rate. Moisture appeared to be a significant contributing factor to the enhancement of the chem. and phys. instability of ascorbic acid tablets.

INDICES :

Part three contain Appendices which includes :

Appendix A. Symbols and abbreviations

Appendix B. Index

The index of Author-subject and title is in alphabetical sequence. Index guides to the specific entry/entries in the bibliography. I hope it will be found useful in making use of bibliography.

LITERATURE CONSULTED

I. The Secondary sources consulted are :

1. Biological Abstracts
2. Chemical Abstracts.
3. Index Medicus.

II. The primary sources consulted are :

	Title	abbreviation
1.	Analytical Chemistry	Anal. Chem.
2.	Asian Journal of Chemistry	Asian J. Chem.
3.	Biochemical Journal	Biochem. J.
4.	Biochemical Plants	Biochem. Plants.
5.	Bulletin of Chemical Society Japan	Bull.Chem. Soc. Jpn.
6.	Canadian Journal of Chemistry	Can.J. Chem.
7.	Chromatographical Science	Chromatogr. Sci.
8.	Current Science	Curr. Sci.
9.	Electroanalysis	Electroanalysis.
10.	European Journal of Solid State Inorganic Chemistry	Eur.J. Solid State Inorg. Chem.
11.	Hetrocycles	Hetrocycles.
12.	Indian Drugs	Indian Drugs.
13.	Indian Journal of Agricultural Science	Indian J.Agric. Sci.
14.	Indian Journal of Botany	Indian J. Bot.
15.	Indian Journal of Chemistry	Indian J. Chem.
16.	Indian Journal of Pure and Applied Physics	Indian J. Pure Appl. Phys.
17.	Indian Journal of Technology	Indian J. Tech.

18. Inorganic Chemistry	Inorg. Chem.
19. International Journal of Vitamins and Nutritional Research	Int.J. Vitam. Nutr.Res.
20. Journal of American Chemical Society	J.Am. Chem. Soc.
21. Journal of Chemical Education	J. Chem. Educ.
22. Journal of Chemical Society of Pakistan	J. Chem. Soc. Pak.
23. Journal of Chromatography	J. Chromatogr.
24. Journal of Colloid Interface Science	J. Colloid Interface Sci.
25. Journal of Electro-analytical Chemistry. Interfacial Electro Chemistry	J. Electro. Anal. Chem. Interfacial Electrochem.
26. Journal of Electrochemical Society	J. Electro chem. Soc.
27. Journal of Indian Chemical Society	J. Indian Chem. Soc.
28. Journal of Organic Chemistry	J. Org. Chem.
29. Journal of Physical Chemistry	J. Phys. Chem.
30. Journal of Plant Physiology	J. Plant Physiol.
31. Journal of Radio analytical and Nuclear Chemistry	J. Radio-anal. Nucl. Chem.
32. Plant Cell Physiology	Plant Cell Physiol.
33. Plant Science	Plant Sci.
34. Polymer	Polymer.
35. Talanta	Talanta.
36. Tetrahedran	Tetrahedran.

PART ONE

INTRODUCTION

ASCORBIC ACID

HISTORY

The history of scurvy research leading to the discovery of vitamin C only began in 1907 when Holst and Frolich found the guinea pig to be as susceptible to scurvy as man. The findings that the disease could be experimentally produced led to the development of an assay for the biologic determination of the antiscorbutic potency of foodstuffs. Between 1910 and 1921 Zilva and his associates extracted the elusive substance from lemons and discovered that the antiscorbutic activity was probably associated with a capacity for reducing phenolindophenol. In 1922, Drummond's proposal to name the antiscorbutic factor vitamin C was accepted.

The characterization of vitamin C was first accomplished by Szent-Gyorgyi in 1928. He isolated a reducing agent in crystalline form from orange juice, cabbage juice, and adrenal glands that he call "hexauronic acid". In 1932, Svirbely and Szent-Gyorgyi and independently King and Waugh" demonstrated hexuronic acid to be identical with vitamin C. In 1933, Hirst and Haworth determined the structure of vitamin C, and Reichstein worked out a synthesis that 50 years later still forms the bais for large scale industrial production. The name L-ascrobic acid was coined by Haworth and Szent-Gyorgyi in 1933 to point out the antiscorbutic properties of vitamin C. It was proved unambiguously that the synthetic products has the same biologic activity as

the product isolated from natural tissues.

CHEMISTRY AND ANALYTICAL DETERMINATION

Ascorbic acid is a white, odorless, crystalline solid with a sharp acidic taste. Its chemical composition is $C_6H_8O_6$, resulting in a molecular weight of 176.13. At 190 to 192°C decomposition takes place. One gram of ascrobic acid dissolves in 3 ml water, but it is insoluble in most organic solvents.

The original structure determination of L-ascorbic acid was confirmed by the synthesis from L-xylose, assigning it to the L-series. Biosynthesis of ascorbic acid in animals and plants begins from either D-glucose or D-galactose. Chemical synthesis starts from glucose, but follows different steps. In addition to vitamin C and L-ascorbic acid, there exist the chemical names, L-xyoascrobic acid and L-threo-hex-2-uronic acid -lactone. Among the chemical properties of ascorbic acid, the reversible oxidation-reduction with dehydro-L-ascorbic acid is the most important and is probably the basis for most of its known physiologic functions. Although ascorbic acid is stable when dry, it tends to undergo rapid oxidation by atmospheric oxygen in an aqueous solution. No dehydroascorbic acid could be found in these solutions kept at room temperature. Ascorbic acid in tap water becomes more stable with increasing concentrations, and it is rapidly oxidized below a concentration of 10 mg/dl. In aqueous solutions, it is more sensitive to

alkalies than to acids; it is most stable at pH 4 to pH 6. Ascorbic acid is sensitive to heat. Most metals, especially copper, catalyze its oxidation. Degradation products of ascorbate are dehydroascorbic acid, 2,3-diketo-L-gulonic acid, oxalic acid, and L-threonic acid. In acidic solution, the degradation process furnishes a number of additional products.

In liquid vitamin preparations, the degradation of ascorbic acid depends on the composition of the mixture; preaddition of this vitamin to TPN solutions must be avoided. Of the various derivatives and analogues prepared, only salts and C-6 substituted esters have biologic activity. They are readily converted to ascorbic acid in the body.

A large number of spectroscopic, electrochemical, enzymatic, and chromatographic methods for the analysis of ascorbic acid in food products, pharmaceuticals, and biologic samples have been described. Colorimetric reactions with metal ions, which are unspecific and subject to interference by a large number of substances contained in foods and other natural products, can be combined with enzymatic techniques in order to increase specificity without losing the advantage of a simple and fast method. The application of gas chromatography dramatically improves the sensitivity and selectivity of the analysis, but ascorbic acid has to be transformed into a derivative.

The separation of ascorbic acid from other compounds with high-performance liquid chromatography (HPLC) allows the detection of an isomer, erythorbic acid, together with ascorbic acid using electrochemical detection. The determination of ascorbic acid together with its oxidized form (dehydroascorbic acid) is only possible after transformation into a derivative. HPLC allows the highly selective and sensitive detection of ascorbic acid in tissues and plasma. However, the appropriate method must be chosen according to the nature of the sample and the lab facilities. To assess the biologic activity of ascorbic acid, a test system is required that is dependent on ascorbic acid. For practical reasons, the guinea pig is virtually the only suitable model, although monkeys may also be used.

SOURCES OF VITAMIN C

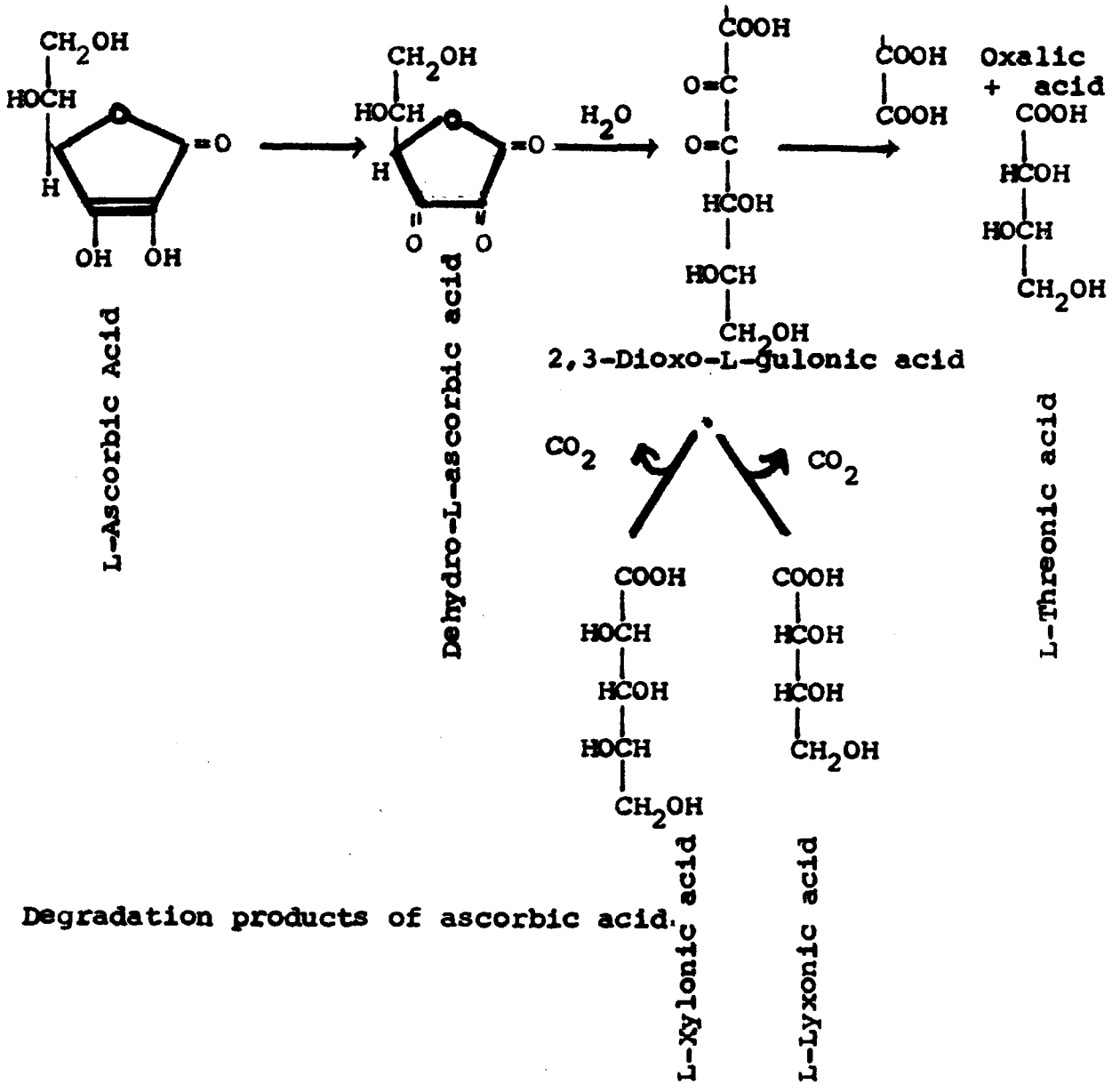
Ascorbic acid occurs in all living tissues, which is not surprising in view of its redox function in cell metabolism. Important sources of vitamin C are fresh fruits and vegetables.

ABSORPTION, DISTRIBUTION, ELIMINATION

Vitamin C has been demonstrated in guinea pigs and in man to be absorbed in the intestine by an active Na-dependent, energy-requiring, electroneutral, carrier-mediated transport mechanism. The apparent K_m values for transport of ascorbate into brush border membrane vesicles from guinea pig small intestine were determined to be approximately

0.3 mmol; in model experiments with human material, K_m was found to be 0.5 mmol. Absorption in the rat and in all species that are not prone to scurvy follows a passive diffusion mechanism.

Because an active transport mechanism is a saturable process, the relative absorption capacity is reduced with increasing intakes of the compound. In volunteers, saturation



Degradation products of ascorbic acid.

kinetics of absorption were demonstrated with a K_m of 5.44 mmol at different vitamin C concentrations. The transport was studied by intestinal perfusion of vitamin C using the triple lumen technique. With a pharmacokinetic approach, at oral intakes increasing from 1.5 to 12 g, the relative absorption decreased from approximately 50% to only 16%. An average absorption of 70% was extrapolated for intakes of up to 180 mg. Estimation of the absorption of ascorbic acid in volunteers using (1-^{14}C) ascorbic acid yielded a mean absorption of 84% of the dose (upto 180 mg) as estimated from the urinary elimination of (^{14}C) radioactivity. Similar results were found in smokers (mean 76%). These results indicate losses of up to 20% during the absorption process of physiologic doses. This conclusion can be made because the appearance of label in the feces is negligible.

The absorption capacity of the intestine for vitamin C in man was found to be saturated at oral intakes of 3 g. By using urinary ascorbate excretion as a parameter, researchers determined an absorption of 75% with an intake of 1 g as a single dose, of 44% with 2 g, of 39% with 3 g, of 28% with 4 g, and of 20% with 5 g of the ingested dose. A maximum absorption capacity of approximately 1,200 mg was calculated, which is reached with a single intake of 3 g. The absorption capacity can only be increased by administration of graded intakes. Following loading with 5 x 1 g ascorbic acid daily, the urinary excretion within 24 hours resulted in 1,600 to 1,800 mg, whereas with in-takes of

5 x 2 g of ascorbic acid, the excretion rose to approximately 2,500 mg, indicating an absorption of 30% and 25% of the dose. Increasing intakes of ascorbic acid resulted in an increase of urinary excretion of unaltered ascorbic acid, since in man the mechanism of elimination involves a saturable Na-dependent and potentially sensitive reabsorption process. Studies on the kinetic behaviour of (1-^{14}C) ascorbic acid demonstrated that the steep increase in renal turnover of unmetabolized ascorbic acid observed at plasma concentrations of 0.8 to 0.9 mg/dl is the consequence of the saturability of the reabsorption process. This value indicates the threshold.

The investigation by Kallner et al. using (1-^{14}C) ascorbic acid as trace (15 to 25 uCi per subject) demonstrated that the percentage of total urinary radioactivity excreted as unmetabolized (1-^{14}C) ascorbic acid increases with intakes of unlabeled ascorbic acid. In addition, with low intakes (30 mg/day), a substantial amount was excreted unaltered in urine (6.6%). Thus, with large intakes only 10 to 15% of the total urinary excretion derived from ascorbate can be represented by metabolites. With the limited absorption capacity of the intestine with high intakes, then the total amount of metabolites that may be formed from ascorbic acid will not be higher than 100 to 150 mg/day, even with very high intakes.

The distribution of ascorbic acid has been reported for mice, rats, and guinea pigs. Ascorbic acid is widely

Content of Ascorbic Acid in Selected Foods

Food	mg/100 g
fruits of Terminalia ferdinandiana (Australia)	3.000
acerola	2.000
hips	1.000
black currants	200
broccoli	70-160
brussels sprouts	90-150
cauliflower	50-90
strawberries	40-90
lemons	50-80
cabbage	50-80
oranges	40-60
grapefruit	35-45
pineapples	20-40
turnips	15-40
liver, kidney	10-40
tomatoes	10-30
peaches	5-25
potatoes	10-20
beans	10-20
peas	10-15
apples	5-10
bananas	5-10
cow's milk	1-2
meat,beef, and pork	upto 2

Unchanged Ascorbate Recovered from Urine*

Dosage (mg/day)	Number of Subjects Studied	^{14}C-Ascorbate (%)
1 x 30	4	6.6
2 x 30	4	20.3
2 x 45	3	34.1
4 x 45	4	61.7
4 x 250	4	82.4
4 x 500	3	87.9
2 x 1.000	8	87.0

*In relation to total amounts of radioactivity in urine, at various levels of oral intake.

distributed throughout the tissues. In man, the highest concentrations were found, by analyses of postmortem specimens, in the adrenal and pituitary glands (30 to 50 mg/100 g wet tissue). High levels were also found in liver, spleen and brain (10 to 15 mg/100 g wet tissue), but their contribution to the total body pool was be far larger than that from glands and secretary organs. At present, no information is available on tissue concentrations of ascorbate in man following continuous high intakes. Studies have documented that the body pool of ascorbic acid approaches "saturation" at approximately 20 mg/kg of body weight, but it has been claimed that the pool may be further enlarged with intakes far higher than the physiologic range.

METABOLISM

A number of review papers on the metabolism of ascorbic acid have been published in the past decade. In animals such as guinea pigs and rats there is a considerable conversion of carboxy-group labelled ascorbic acid to carbon dioxide. In guinea pigs, respiratory exhalation of (^{14}C) carbon dioxide after administration of (1-^{14}C) ascorbic acid is the major route of catabolism. Urinary and fecal excretion

Ascorbic Acid Levels of Adult Human Tissues

Tissue	Ascorbic Acid (mg 100 g wet tissue)
Adrenal glands	30-40
Pituitary gland	40-50
Liver	10-16
Spleen	10-15
Lungs	7
Kidneys	5-15
Testes	3
Thyroid	2
Heart muscle	5-15
Skeletal muscle	3-4
Brain	13-15
Pancreas	10-15
Eye lens	25-31
Plasma	0.4-1.0
Saliva	0.07-0.09

contribute only to a minor part. Of the approximately 8 to 10% of label recovered in urine, unchanged ascorbic acid, dehydroascorbic acid, and 2,3-diketo-L-gulonic acid accounted for approximately 2 to 3% of the given dose. Most of the excreted label was incorporated in oxalate (7% of the given dose). Other metabolites were isolated and identified in rat and/or guinea pig urine; 2-O-methyl ascorbate, ascorbic acid 2-sulfate, and saccharoascorbic acid, all of which are excreted in small amounts.

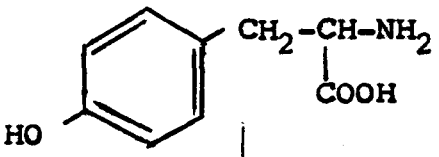
BIOCHEMICAL AND PHYSIOLOGIC FUNCTIONS

L-Ascorbic acid is a cofactor of hydroxylating enzymes, either as part of the active site or as a protective reducing agent. However, these enzymatic reactions cannot be used as early signs of vitamin C depletion at this time because the relationship between enzymatic activity and vitamin concentration is not well documented. Owing to its reducing properties and its reaction with free radicals, however, it plays important roles in many biochemical reactions. Although actual reaction mechanisms are not fully understood at the molecular level, there is evidence that ascorbic acid may be critical in reactions depending on reduced iron or copper. The only role of ascorbic acid that is categorically established is its function in the prevention and cure of clinical scurvy.

Collagen Synthesis : Hydroxylation of proline is essential for the formation and stabilization of the triple helical

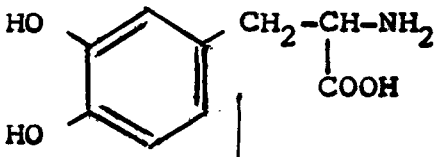
structure of collagen. Hydroxylation of lysine is essential for glycosylation and therefore for the formation of hydroxylsine-derived cross-links. These reactions are catalyzed by prolylhydroxylase (EC 1.14.11.2) or lysyl hydroxylase (EC 1.14.11.4) both of which required iron in the ferrous form. Oxygen and 2-oxoglutarate inactivate prolylhydroxylase unless ascorbic acid is present, which presumably prevents S-S bridge formation in the enzyme. Although compounds such as tetrahydropterin, tetrahydrofolate, cysteine, and dithiothreitol can function as reducing agents, ascorbic acid is the most efficient agent and the physiologic cofactor. Lack of ascorbic acid results in under-hydroxylated proline in tropocollagen, which leads to a reduced stability of connective tissue. In guinea pigs, skin, bone and tendon are sensitive to ascorbate deficiency, whereas internal organs such as skeletal muscle, lung, heart, and kidney exhibit only small effects.

Beneficial effects have been claimed for ascorbic acid in doses of 1 to 4 g daily in humans suffering from pressure sores, ulcers, and Ehlers-Danlos syndrome type VI (lysyl hydroxylase deficiency). In a double-blind controlled clinical trial in a group of 20 surgical patients suffering from pressure sores, the treatment with 1 g ascorbic acid daily was followed by an 84% reduction of the ulcers, whereas the corresponding reduction in the placebo group was 43%. Seven patients given 1 g ascorbic acid daily showed an increased collagen synthesis at the site of pressure sores



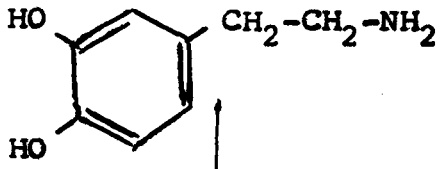
Tyrosine

Tyrosine-3-mono-oxygenase



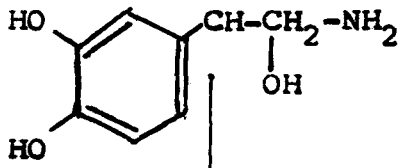
Dopa
(3,4-Dihydroxy-L-phenylalanine)

Aromatic amino acid decarboxylase



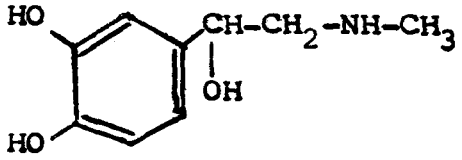
Dopamine

Dopamine-beta-mono-oxygenase



Noradrenaline

Noradrenaline-N-methyltransferase



Adrenaline

Biosynthesis of catecholamines. Ascorbic acid acts as a cofactor of dopamine- -mono-oxygenase.

compared with other patients given a placebo. A higher rate of complete or partial healing of leg ulcers could be observed in individuals with -thalassemia given 3 g ascorbic acid daily in a double-blind cross-over trial. In one patient with Ehlers-Danlos syndrome type IV, the application of 4 g ascorbic acid daily led to an improvement of wound healing, corneal growth, bleeding time, muscle strength, and pulmonary residual volume.

Carnitine Synthesis : L-Carnitine is essential for carrying long-chain fatty acids into mitochondria for -oxidation, providing energy to cells, especially to myocardium and to skeletal muscle. The distribution of enzymes involved in carnitine metabolism, e.g., short-chain and medium-chain carnitine acyltransferases, has led to the conclusion that carnitine has multiple roles in mammalian metabolism. The highest concentration of carnitine is found in the epididymis (60 mmol). Therefore, carnitine may play an important role in the maturation and maintenance of spermatozoa. Carnitine can be either obtained via the diet or synthesized from lysine and methionine. Two dioxygenases in this pathway (EC 1.14.11.8 and EC 1.14.11.1) are dependent on ferrous iron and L-ascorbic acid similar to prolyl and lysyl hydroxylases. Studies in guinea pigs have shown that ascorbic acid depletion results in a significant reduction in skeletal and heart muscle carnitine well before any classic signs of scurvy can be observed, whereas brain and serum contains remain unchanged. Experiments with perfused guinea pig

livers demonstrated that the -butyrobetaine, 2-oxoglutarate-dioxygenase, but not the trimethyl-lysine, 2-oxoglutarate dioxygenase, becomes the rate limiting enzyme in ascorbate deficient animals. Muscle carnitine may therefore be a highly sensitive indicator of ascorbate status. Furthermore, symptoms such as fatigue and lassitude seen in vitamin C depleted human volunteers may be the result of poor energy production due to decreased carnitine biosynthesis.

Noradrenaline Synthesis : One of the enzymes of the biosynthesis of noradrenaline and also of adrenaline from tyrosine, the copper-containing dopamine -mono-oxygenase (EC 1.14.17.1), necessitates stoichiometric amounts of ascorbic acid. This enzyme catalyzes the incorporation of oxygen into the side chain of dopamine, forming the end-products noradrenaline and water. Thus, the function of ascorbic acid in this reaction is clearly different from its role in collagen and carnitine synthesis. Noradrenaline is synthesized in neural tissues and in the adrenal medulla. Experiments with guinea pigs deficient in ascorbic acid suggest that the synthesis of biogenic amines is dependent on the ascorbic acid status. Ascorbic acid consumed during the biosynthesis of noradrenaline in adrenal chromaffin granules must be regnerated in order to maintain intragranular reduced ascorbic acid. Cytosolic ascorbate serves as a source of reducing equivalents, and cytochrome b_{561} may act as an electron shuttle between the ascorbate pools.

Furthermore, the injection of ascorbate into the brain affects dopamine function by increasing its metabolism to noradrenaline. Therefore, vitamin C therapy is claimed by some to be of advantage in conditions of dopamine excess such as schizophrenia, chorea, and dyskinesia.

Steroid Synthesis : Ascorbic acid is released from the adrenal glands upon stimulation by adrenocorticotropic hormone. Although some of the metabolic steps of steroid hormone synthesis are hydroxylations, no direct function of ascorbic acid is known. Only the steroid-21 mono-oxygenase (EC 1.14.99.10) has been shown to be inhibited by ascorbate in vitro.

Drug Metabolism : Many drugs and toxic agents produced by the body must be modified before excretion. Hydroxylation and other reactions occur in liver microsomes and reticuloendothelial tissues by the mixed function oxygenase system, which requires a number of components : hydroxylating and demethylating enzymes, flavoproteins, cytochrome P450, oxygen, and reducting agents in the form of NADP or NAD. This mixed function oxidase is depressed by 50% in ascorbic acid deficient guinea pigs if the liver ascorbate drops to 40% of normal. However, extrahepatic detoxification systems and some hepatic drug metabolizing enzyme systems are less dependent or even independent of ascorbic acid status.

Ascorbic Acid in Iron Nutrition : Iron is an essential nutrient that plays a vital role in oxygen transport as well as in many other metabolic processes. Ascorbic acid is a powerful promoter of non-heme iron absorption from food and acts by reducing the ferric iron in the stomach and by forming complexes with iron ions that remain in solution at the alkaline pH in the duodenum. To be most effective, ascorbic acid should be ingested together with food. The effect of ascorbic acid is dose dependent, and the iron absorption is increased manifold. Because even small increases in the content of ascorbic acid in food enhance iron absorption, ascorbic acid is the most suitable compound to stimulate iron absorption and to improve iron nutrition. The effect on iron absorption together with the action on carnitine biosynthesis may explain why the working capacity is impaired in vitamin C inadequacy.

Of a population of approximately 200 school children aged 12 to 15 years, 30% exhibited a vitamine C level below 2.0 mg/L, as well as deficiencies of riboflavin (33%) and pyridoxine (17%). Supplementation with 70 mg ascorbic acid, 2 mg riboflavin, and 2 mg pyridoxine daily for three months resulted in a significantly increased working capacity, serum iron, transferrin saturation, and vitamin C plasma level.

EXTRASCORBUTIC AND PHARMACODYNAMIC FUNCTIONS

Apart from the basic antiscorbutic role, ascorbic acid has prophylactic and therapeutic effects in pathologic

conditions. These conditions include infectious diseases, immune deficiency disorders, atherosclerosis, malignant disease, nitrosamine formation, and toxicity of heavy metals. These functions emerged from clinical and experimental studies that used ascorbic acid in doses of up to 1 g daily or more.

Ascorbic Acid and Immunity : The immune response consists of cellular and humoral immune functions. Ascorbic acid has been shown to increase some cellular immune functions in vitro and in vivo, and to influence humoral immune reactions. The migration of human neutrophils toward leukoattractants can be stimulated by ascorbic acid in vitro and in vivo. An oxidative environment, such as the myeloperoxidase/H_2O_2/halide system, completely blocks the chemotaxis of granulocytes. This process can be reversed by ascorbic acid. The importance of the action of ascorbic acid can best be demonstrated in diseases in which leukocyte functions are impaired, such as chronic granulomatous disease, an inherited disorder of neutrophil function. The defect in the killing of microorganisms leads to repeated bacterial infections. In patients, addition of 1 g ascorbic acid daily or 50 mg/kg/day to standard therapy improved the chemotaxis of neutrophils, leading to a dramatic reduction of infectious attacks. Ascorbate has also been reported to restore partially or completely the antimicrobial activity impaired in the Chediak-Higashi syndrome.

Data indicate that ascorbic acid modulates cyclic nucleotide levels in B as well as in T cells, a process that may mediate immune reactions. Humoral factors involved in the immune response include histamine and prostaglandins. Oral administration of ascorbate to 11 volunteers resulted in a reduction of blood histamine levels. On the other hand, intracellular ascorbic acid is essential for the release of small quantities of histamine. How ascorbic acid regulates the histamine level is not clear. Furthermore, ascorbic acid may also be involved in the release of prostaglandins of the E and F types as well as in the synthesis of prostacyclin.

Ascorbic Acid and Lipid Metabolism : The function of ascorbic acid on the cholesterol-7-mono-oxygenase has been discussed previously. The plasma triglyceride concentration increases in vitamin C deficient guinea pigs, which results in an accumulation of triglycerides in liver and arteries. Vitamin C administration in gram amounts to hyperlipidemic subjects and to two patients with hypertriglyceridemias led to a massive decrease in circulating triglycerides. Ascorbic acid may also be effective in reducing the incidence of thrombotic episodes. A clinical trial with surgical patients who received 1 g vitamin C daily or a placebo showed that the incidence of thrombosis was reduced by 50% in the supplemented group. Circumstantial and indirect evidence has indicated that hypovitaminosis C may be a risk factor in

arterial diseases. However, additional trials must substantiate the still controversial role of ascorbate in lipid metabolism.

Ascorbic Acid and Cancer : The debate about a possible role of of ascorbic acid in cancer therapy started when data from a trial with 100 terminal cancer patients were published. Ten g ascorbic acid daily was claimed to increase the survival time fourfold as compared with 1,000 claimed matched historical controls. The authors concluded that supplemental ascorbate can offer some degree of benefit to all advanced cancer patients. A controlled clinical trial did not confirm these results, but these patients had received chemotherapy that impairs immunologic functions. To overcome this problem, the study was repeated, with the same negative results, in a controlled double-blind clinical trial with 100 patients suffering from colorectal cancer. These patients had not received chemotherapy or irradiation, as opposed to the former study. An exchange of views about this controversy has been published.

Observations of terminal cancer patients in two hospitals who were receiving either low-dose ascorbate (4 g daily or less) or high dose ascorbate (5 g daily or more) showed a significantly higher median survival of 105 days in the high-dose group compared with 35 days in the low-dose group. The administration of ascorbic acid seemed to improve the well-being of many cancer patients, as measured

decreased requirement for pain-controlling drugs, improved appetite, and increased mental alertness. However, these studies were poorly controlled, and the classification of "low-dose" and "high-dose" was arbitrary. Furthermore, the site of primary tumor seems to be important for the effectiveness of ascorbic acid; uterus and stomach are the most promising. In vitro an inhibitory effect of ascorbic acid on the growth of human melanoma cells was demonstrated. In 1 mmol ascorbate in melanoma colonies were observed, and in 0.6 mmol ascorbate the ability of melanoma cells to form colonies was 10 to 20 times less than for normal human amniotic cells. Again, additional controlled studies are needed to eventually establish a role for vitamin C in cancer.

MARGINAL VITAMIN C DEFICIENCY

Marginal deficiency of nutrients is associated with reduced biochemical functions without the appearance of clinical symptoms. Depending on the duration of undernourishment, various phases of vitamin C depletion can be observed.

The preliminary stage of depletion is caused by an inadequate availability of vitamin C owing to either dietary changes, malabsorption, or increased requirements (e.g., pregnancy, lactation, smoking). Plasma concentration of vitamin C remains normal or is slightly reduced.

In the biochemical deficiency stage, a reduction in plasma and leukocyte concentrations and in urinary excretion

of ascorbic acid and metabolites occurs. Only a limited amount of vitamin C is ingested, which is not sufficient to maintain the body pool. First correlations with certain enzyme activities or certain physiologic parameters, such as the proline/hydroxyproline ratio, serum carnitine, or histamine concentrations, may be noted.

The physiologic deficiency stage is accompanied by the concurrent appearance of unspecific symptoms such as loss of appetite, physical fatigue or weakness, reduced working capacity, impaired immune response, retarded wound healing, and poor iron absorption. This stage may be maintained over months by a limited intake of vitamin C without the appearance of manifest clinical deficiency symptoms, but may also be a transient situation in the case of extreme physiologic or pathologic conditions. It is only in the clinically manifest vitamin deficiency stage that clinical symptoms related to overt scurvy are noted.

The first three stages can be understood as a definition of latent vitamin C deficiency, and they can be considered as marginal vitamin C deficiency. There are two possibilities ; The supply of vitamin C may be so small that after a short time (80 to 100 days) the vitamin C body pool is depleted. This situation causes the rapid appearance of clinically manifest vitamin C deficiency. On the other hand, when only a limited amount of vitamin C may be ingested daily for a long time, no clinical signs are observed.

As a result, such a person remains in a long-lasting stationary marginal vitamin C deficiency state.

What factors might cause or initiate this marginality of vitamin C and to what extent it is prevalent in certain population segments have been considered in several investigations. Two types of factors will be highlighted ; those affecting the intake of vitamin C, such as season, age, institutionalization, hospitalization, and chronic disease; and those affecting metabolism or daily requirement, such as pregnancy, lactation, longterm drug therapy or alcohol abuse, smoking and acute disease.

Reports are available demonstrating seasonal differences in vitamin C reserves. The lowest levels occurs at the end of winter, and the highest levels during summer months. This finding was also documented in an epidemiologic study. Healthy and hospitalized persons showed a fall in vitamin C reserves in late winter and early spring. Whereas the healthy individuals remained adequately supplied deppite, insufficient intakes, a large percentage of those with marginal intakes in hospital became depleted. The impact of seasonal variation in vitamin C intake was seen in the risk that higher requirements, caused by infection or any other disease, will further deplete the body pool and result in a marginal vitamin C deficiency.

Numerous reports have shown low plasma and leukocyte ascorbate levels in the elderly. This finding is also

reflected by the concentrations in tissues analyzed in postmortem samples. As an example, brain ascorbate concentration fell in one study to as little as 25% of that found in children. In elderly persons living at home or in nursing homes, vitamin C deficits were more prevalent when compared with the profile in young healthy subjects. Vitamin C levels were strikingly depressed in the noninstitutionalized elderly as compared with the institutionalized population or the controls (healthy volunteers). In another study on nutrition in the elderly involving 48 subjects, 63% had plasma vitamin C levels below 0.2 mg/dl and were at a high risk of vitamin C deficiency. All of the men and 68% of the women showed plasma levels below 0.4 mg/dl. Elderly men required a higher daily intake of vitamin C to maintain the same plasma level as the elderly women. In a longitudinal study on the nutritional and health status of a large elderly population, daily intakes needed to maintain a plasma vitamin C level of 1.0 mg/dl were estimated to be 75 mg for women and 150 mg for men. In evaluating the relationship between nutritional status and mental function (cognitive functioning) in the same elderly population, the authors stated that subclinical malnutrition may play a role in the depression of cognitive function observed in some of the elderly individuals, or that depressed cognitive function may result in reduced nutrient intake. These data document the importance of normalizing the vitamin status in the elderly by adequate intakes.

Evaluation of the nutritional status of patients upon consecutive admissions to a general medical service revealed 5 of 108 patients with serum vitamin C levels within the scorbutic range of less than 0.2 mg/dl. Of the patients hospitalized 2 weeks or longer, approximately 25% showed a deterioration of their vitamin C status. Estimation of several vitamins in 656 hospital inpatients by means of dietary interview, biochemical studies, and a clinical evaluation showed that a vitamin C deficiency state occurred more frequently in elderly, obese, or sedentary subjects, and more frequently in male than in female patients.

Subclinical vitamin C deficiency is often seen in chronic or acute disease states. In chronic disease,however anorexia is considered to be the major cause for the lowered vitamin C status. In acute disease it is unlikely that the cause is dietary restriction only because the vitamin C concentration falls rapidly. The vitamin C status in one study was marginally deficient in gastrointestinal disorders such as peptic ulcers and duodenal ulcers, and in intestinal malabsorption. Malnutrition is common in malabsorption. Of the patients with steatorrhea, about 40 to 50% had low serum vitamin C levels. Subnormal leukocyte ascorbate levels were noted in about 15% of patients with nonalcoholic chronic liver disease. A highly significant reduction was also seen in chronic alcoholics without any liver disease. Ethanol caused a significant attenuation of the increase

Prevalence of Marginal Vitamin C Deficiency in Disease States

Disease State	Percentage with Low Vitamin C Status
Malnutrition Steatorrhea	40-50
Nonalcoholic liver disease	35
Alcoholic liver disease	57
Rheumatoid disease	85
Cancer	71
Malignant disease	65

in plasma vitamin C after ingestion of vitamin C. This finding was interpreted as an adverse effect of alcohol on the absorption of ascorbate.

Of rheumatoid patients 85% were deficient in vitamin C. Because their dietary intake of ascorbate did not differ from that of controls and absorption was found to be normal rheumatoid subjects may utilize ascorbic acid at a faster rate, possibly owing to drug vitamin interaction. Nutritional depletion is a common accompanying phenomenon in patients with cancer. Low vitamin C levels were found in 71% of 120 cancer patients. A rapid decrease in leukocyte vitamin C level occurred in the first 24 hours following myocardial infarction. Within 12 hours the mean level in ascorbate had fallen to 8.5 ug/10^8 leukocytes, and the serum ascorbate level to 0.32 mg/dl, indicating marginal

vitamin C deficiency status. This lowering of ascorbate concentrations may be a general effect in states of stress, that is, the body's response to physical infective or traumatic insult.

Numerous reports demonstrate a negative effect of long-term cigarette smoking on plasma and leukocyte vitamin C levels. These levels were reduced by up to 43%. This phenomenon is caused by a higher metabolic turnover in smokers, 70.0 ± 20.2 (17) mg/day, compared with 37.7 ± 9.3

Plasma Vitamin C Levels in Smokers and Nonsmokers

Vitamin C Plasma Concentration (mg/L)		
Nonsmokers	Smokers	P
9.1 ± 3.8 (91)*	5.2 ± 3.9 (31)	0.00001
6.2 ± 4.0 (32)	4.4 ± 2.8 (22)	0.037
1.8 ± 0.1 (34)	1.3 ± 0.2 (18)	0.00001
7.4 ± 3.8 (80)	5.1 ± 3.7 (96)	0.00001
9.6		
5.9		
8.8 ± 2.7 (10)	6.9 ± 2.6 (12)	0.0545
6.0 ± 1.9 (14)	4.2 ± 2.2 (14)	0.0143
13.2 ± 2.4 (12)	13.2 ± 2.4 (7)	0.5
6.6 ± 2.1 (100)	3.9 ± 1.3 (96)	0.00001

*Mean ± SD (N)

(14) mg/day in nonsmokers. Therefore, it would appear that, for reasons yet unknown, smokers require a 40% higher intake than nonsmokers to maintain comparable vitamin C plasma levels. Because the half-life of ascorbic acid in smokers is shorter at lower plasma concentrations than in nonsmokers, smokers have a higher risk of becoming deficient in vitamin C than nonsmokers, should there by a restriction in the normal vitamin C intake.

The increased need for vitamin C during pregnancy and lactation is also well documented, and most official recommendations for the intake of this vitamin have considered this fact. A marginal vitamin C deficiency state is only seen when a woman has a low vitamin C status before pregnancy, since during pregnancy the vitamin C levels fall progressively. During prolonged lactation, exclusively breast-fed infants were found to be well protected against vitamin C undernutrition. They maintained their vitamin C status independently of the maternal vitamin C status and the milk vitamin C concentration, but marginal vitamin C nutrition of lactating mothers was more common than assumed. Significantly decreased plasma vitamin C levels are consistently noted in hemodialysis patients who therefore have an increased requirement for this vitamin.

IMPACT OF MARGINAL VITAMIN C DEFICIENCY ON HEALTH

The most important aspect is the extent to which a marginal vitamin C deficiency status may compromise health.

Are there any symptoms, specific or unspecific, that could clearly be attributed to the lack of ascorbic acid, and will health improve when the marginal vitamin C status is normalized either by an improved diet or by supplementary vitaminC ? This question can only be answered with adequately controlled, double-blind trials with the aim to alleviate or even prevent symptoms related to a marginal vitamin C deficiency state. Because degenerative alterations caused by a continuous hypovitaminosis may take many months or even years to manifest themselves, and may even be irreversible, such investigations are long-term.

It has been suggested that changes in capillary fragility are associated with marginal leukocyte ascorbate concentrations. However, this is a subject with considerable negative data and controversy, Greco et al. investigated a group of 100 subjects, 45 of them apparently healthy, and the remainder with hemorrhagic ocular diseases (hemorrhagic clouding of the vitreous body, central vein thrombosis, apoplectic glaucoma). In all patients the blood vitamin C levels were insufficient. Daily supplementation with vitamin C caused a progressive amelioration of the eye state and a clear regression of the hemorrhagic spots.

In experimentally induced vitamin C deficiency in man, a decreased ability in physical performance was reported at low levels of plasma ascorbate (0.17 mg/dl). Seventy milligrams vitamin C daily, together with riboflavin

and vitamin B_6, improved working capacity as measured by oxygen consumption. Working capacity was significantly reduced when several vitamins (B_1, B_2, B_6 and C) were supplied in the amount of only one third of the Dutch recommended dietary allowances (RDA) for eight weeks. It was not fully restored when twice the RDA of these vitamins was given for two weeks. In young adolescents, the optimum aerobic capacity was associated with a daily intake of 80 to 100 mg of vitamin C or a plasma vitamin C level of 0.8 to 0.9 mg/dl. This relationship was more pronounced in subjects having low or deficient plasma vitamin C concentrations. The increase in plasma vitamin C was accompanied by an increase in aerobic capacity, but only up to a concentration of 0.8 to 0.9 mg/dl.

A relation between histamine and ascorbate concentrations in blood has been shown in pregnant women, adult males, and nonpregnant females. Blood histamine increased gradually when ascorbate dropped below 1.0 mg/dl. The increase in histamine was highly significant at vitamin C concentrations below 0.7 mg/dl.

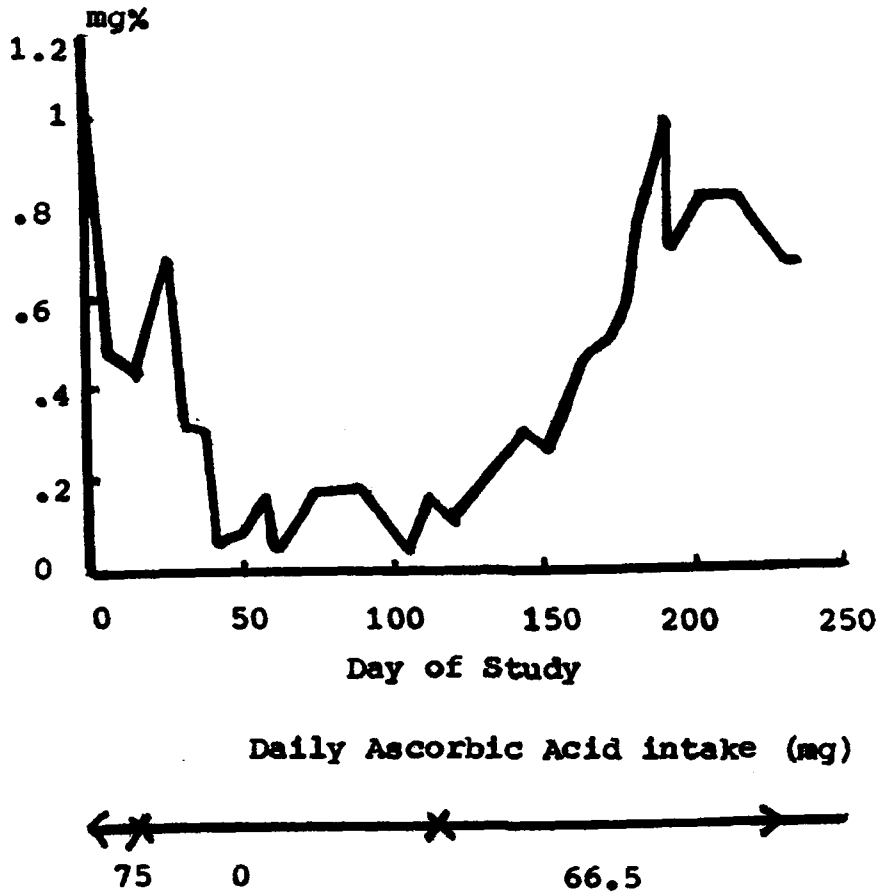
In general, more research is needed to substantiate the impact of a marginal vitamin C deficiency state on physiologic parameters.

VITAMIN C DEFICIENCY IN MAN

Evans described the medical history of infantile scurvy or Barlow's disease. In his Bradshaw Lecture in 1894, Sir Thomas Barlow mentioned the following symptoms :

pallor, inadequate subcutaneous fat, screaming when the legs were handled, pseudoparalysis, swelling of limbs, crepitus due to fracture in or near the epiphyses, occasional proptosis, spongy gums with fetor and bleeding, deformities of the ribs, osseous sheaths surrounding bones, and albumin and blood in the urine.

In the adult, the onset of scurvy may be detected after 60 to 90 days on a vitamin C deficient diet. The earliest manifestations consist of a few petechial spots and small ecchymoses that fade within a few days, but are replaced by others. They first appear when the plasma ascorbic acid ranges from 0.13 to 0.24 mg/dl. Larger ecchymoses may be accompanied by petechiae that become perifollicular in location. At the same time, follicular hyperkeratosis develops, especially on the buttocks, thighs, and calves. Many hyperkeratotic lesions contain fragmented or coiled hairs, and some demonstrated the classic lesion of scurvy ; the hyperkeratotic follicle with a red hemorrhagic halo. Gums become swollen and bleed easily. It is noteworthy that the gums do not become involved if the patient has no teeth, and gum lesions are seldom severe in subjects who practice good dental hygiene. A unique characteristic of scurvy is the development of Sjogren's (sicca) syndrome ; dryness of the mouth and eyes, loss of hair, dry itchy skin, and loosening of teeth and dental fillings. Scurvy may be characterized by weakness and lethargy,



Plasma ascorbate values in scurvy, Average plasma ascorbate values of two men during depletion and repletion.

followed by aching of the legs, arthralgia, and joint effusions. A peculiar form of vasomotor instability may be observed and accompanied by pitting edema of the feet and ankles. Oliguria is also observed in severe scurvy. Psychologic changes, common in this condition, are characterized as the "neurotic triad", which consists of hysteria, depression, and hypochondriasis. Peripheral neuropathy was observed in one scorbutic subject who developed hemorrhages into the femoral nerve sheaths of both legs. The description of scurvy symptoms by Hodges confirms the

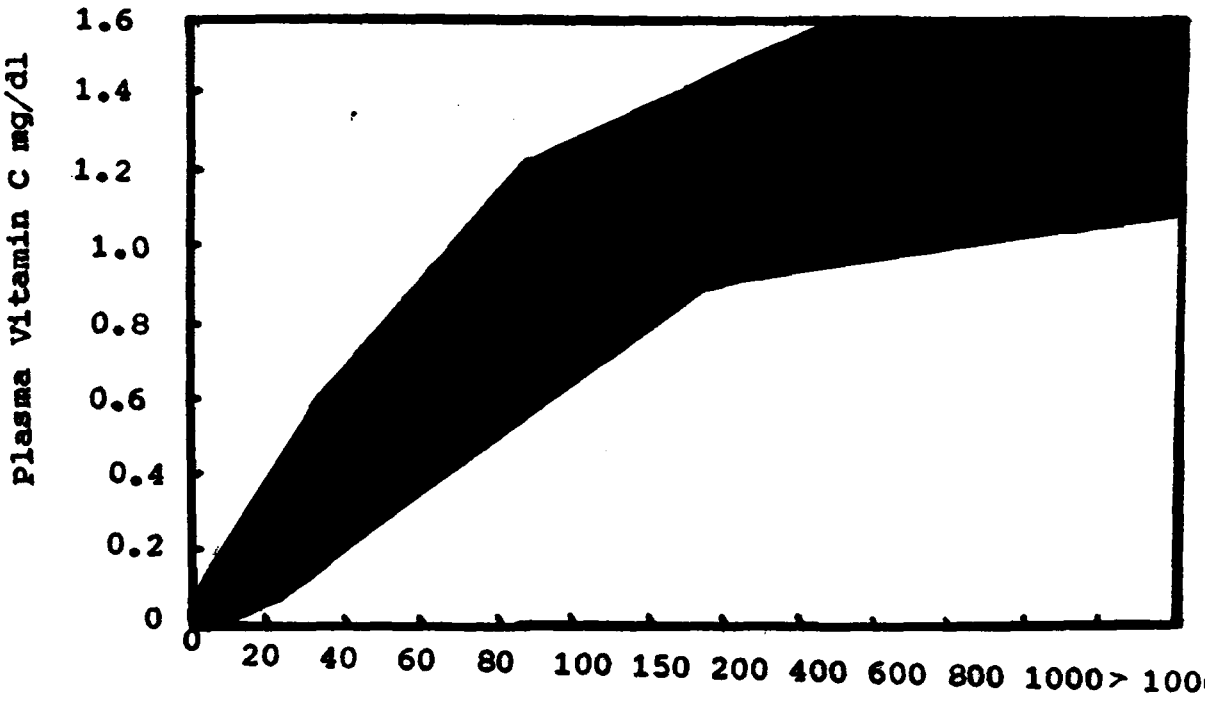
observations made during the experiments of the British Medical Research Council.

Treatment of scorbutic patients must not be delayed because sudden death can result. After several doses of 100 gm ascorbic acid either orally or intravenously, improvement of the severe condition is rapid. Continuous daily administration of vitamin C rapidly repletes the body pool. Whereas the first signs of scurvy are observed at a pool size of 300 to 400 mg, the last signs upon repletion (hyperkeratosis) only disappear at a pool size of about 1,000 mg (healthy adults have a body pool size of approximately 20 mg/kg body weight or about 1,500 mg).

DAILY REQUIREMENTS

Man is dependent on exogenous sources of vitamin C because he is unable to synthesize it endogenously. The supply of vitamin C necessary to offer protection against scurvy is about 10 mg daily. However, ascorbic acid exerts many physiologic as well as extra-antiscorbutic functions for which tissue concentrations greater than those to prevent the emergence of the deficiency disease appear desirable. How much is required to attain optimum health is a matter of controversy, although more evidence is being accumulated, not only for vitamin C, but for all essential nutrients, to allow researchers to establish daily requirements. Therefore, it is not surprising that different

recommended dietary allowances (RDA) exist for the various countries, ranging between 30 mg and 120 mg including groups with increased needs (e.g., pregnant and lactating women, smokers). These differences reflect the various definitions of the RDAs ; either to be adequate to meet the needs of practically all healthy persons, or to be merely sufficient to prevent scurvy. Figure shows the relationship between plasma vitamin C levels and intake of the vitamin, taking into account the 95% range for the mean values in reports published during the last 40 years.



The relationship between plasma levels and intake of vitamin C

In the National Survey of Canada of 1973, three risk categories were introduced. A high risk was postulated to exist for all age groups having a plasma level below 0.2 mg/dl. Conversely, a low risk of vitamin deficiency was expected above 0.4 mg/dl for the age group over 19 years, and above 0.6 mg/dl for those younger than 19 years. A moderate risk was defined to exist at the plasma levels in between. These conclusions were translated into necessary daily vitamin C intakes of 60 mg and 80 mg, respectively, to maintain a low-risk vitamin C nutritional status.

Newton et al. studied the relation between intake and plasma concentration of vitamin C in elderly women. They found a sigmoidal relation demonstrating a rapid change in plasma concentration as the intake increased from 30 to 60 mg daily. This finding suggested saturation of a pathway of metabolic utilization. To protect against impairment of health, the authors of this study suggested maintaining the intake of vitamin C above 60 mg daily.

The most comprehensive survey assessing the overall health status and nutritional status of the population probably is the Nationwide Health and Nutrition Examination Survey conducted by the U.S. Department of Health and Human Services between 1976 and 1980 (NHANES II). It included 21,000 people from 6 months to 74 years of age and provided a representative sample of the civilian noninstitutionalized population. First evaluations regarding vitamin C

nutritional status revealed a close correlation between critical vitamin C serum levels of less than 0.3 mg/dl and intakes corresponding to low percentages of the vitamin C RDA.

A comprehensive review of research on vitamin C requirement of man was compiled by Irwin and Hutchins and more recently by Hornig. Conclusions were derived mostly from blood or plasma levels, from urinary excretion of ascorbic acid or from investigations of the minimum intake of ascorbic acid to prevent the appearance of scorbutic symptoms. Other approaches have been the saturation of the body ascorbic acid and the estimation of the requirement by urinary response to large intakes of this vitamin. As a result of the different methods employed for assessing the vitamin C status, the published estimates of the daily requirement vary considerably. For example, the estimates of the necessary daily intake for children range between 60 and 125 mg.

SAFETY OF VITAMIN C

Reviews on the safety and tolerance of vitamin C have been published along with reports about adverse effects of high doses. The most frequently cited adverse effect of high intakes of ascorbic acid concerns the production of oxalate. However, as outlined in the section on metabolism, vitamin C cannot be considered as a risk factor in oxalate stone formation. Observations on the occurrence of ascorbic

acid deficiencies upon the termination of a high-dose regimen due to a faster turnover are poorly documented or even anecdotal. Long-term administration of massive doses of ascorbic acid to guinea pigs has caused no induction on the metabolizing enzyme system. High doses of vitamin C were reported to destroy vitamin B_{12} in an in vitro system. This statement, however, had to be revised because of analytical inadequacies.

Ascorbic acid may interfere with laboratory tests involving nonspecific color reactions caused by redox mechanisms. Such interactions were reported for the analyses of glucose, uric acid, creatinine, and inorganic phosphate. Ascorbic acid ingested in amounts higher than 1 g/day may appear in feces and may interfere with the detection of occult blood. These unfavourable effects can easily be avoided by using appropriate laboratory methods.

A study in women seemed to confirm earlier findings in animals that high doses of vitamin C caused reduced fertility and fetotoxicity. In humans high doses of vitamin C up to 10 g daily for several years neither reduced the fertility in 3,000 women nor affected the newborn. However, these conclusions have been drawn from occasional observations and not from a controlled study. Furthermore, vitamin C has been used as therapy in nonspecific sperm agglutination where it was reported to increase seminal levels of zinc, magnesium, calcium, and potassium, and has also been used to

induce ovulation in anovulatory women. Other adverse effects frequently cited are occasional diarrhea, deep vein thrombosis, and hemolysis in gluclose-6-phosphate dehydrogenase deficiency. These allegations were based on anecdotal and uncontrolled studies.

PART TWO

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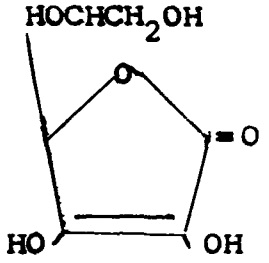

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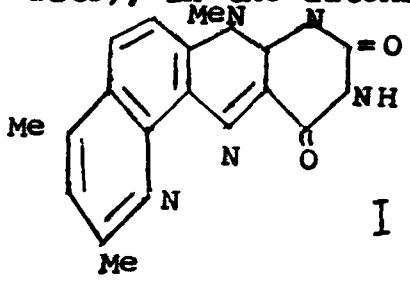

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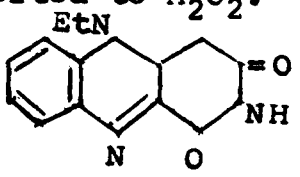


II

The apparent 2nd order rate consts for the quant.oxidn. of $PhCH_2OH$, cyclohexanol, or EtOH were detd. in MeCN under anaerobic conditions; the rate consists for the oxidn. of ascorbic acid by I, $ZrCl_4$ or $ZrCl_4$ II were detd. under

conditions in EtOH contg. 1,5-diazabicyclo [5.4.0] undec-5-ene. The prepn. of I, its electron deficiency, the coordination sites for Zr^{4+} coordination and the effect of $ZrCl_4$ On the UV of I, and the reaction mechanism were discussed.

1. -,-, KINETIC

Kimura, Masaru, Kobayashi, Akiko; Boku, Keiko. Kinetic studies of the oxidation of L-ascorbic acid by the peroxydisulfate ion and of copper (II) catalysis. Bull. Chem. Soc. Jpn. 1982, 55(7), 2068-73.

Kinetic studies of the title oxidn. are carried out at pH 3.4-4.6 and various ionic strength from 0.071 to 1.07 M with $NaClO_4$ and at 4 temps. between 15 and 30° and an ionic strength of 1.07 M. The pH effect is consistent with reaction schemes involving two pH reaction rate is greatly catalyzed by the presence of trace amts. of Cu (II) ion; the mechanisms of the Cu (II). Catalyzed reaction are discussed.

2. -, PALLADIUM ALKYLATION OF

Morena-Manas, Marcial; Pleixats, Roser; Villarroya, Merce. C-Allylation of L-ascorbic acid under palladium (0) catalysis. J. Org. Chem. 1990, 55(16), 4925-8.

L-Ascorbic acid is efficiently allylated at C-2 with primary and secondary allylic substrates by using palladium (0) catalysis. Hydrogenation of the resulting allylated compds.I (R = CH_2 CH :CHRI, CH_2CH: CMe_2, CH_2CMe:CH_2CH_2CMe: CHMe, 3-cyclohexenyl; RI = H, Me, Ph, Bu) affords L-ascorbic

acid derives with satd. chainsate-2, e.g. I (R = $(CH_2)_3Ph$, Bu, cyclohexyl).

13. -, REACTIONS - ALICYLIC ENONES

Sussangkaron, Kawporn; Fodor, Gabor; Karle, Isabella; George, Clifford. Ascorbic acid as a Michael donor part II. Reaction with alicylic enones. Tetrahedron. 1988, 44(23), 7047-54.

The scope of the Michael reaction of L-ascorbic acid (I) was explored by its application of 2-cyclohexen-1-one and 2-cyclopenten-1-one, resp. unexpected acid catalysis was discovered with the reaction.

14. -,-,-,-

Sussangkarn, Kawporn; Fodor, Gabor; Karle, Isabella; George, Clifford. Ascorbic acid as a Micheal donor. Part II. Reaction with alicyclic enones. Tetrahedron. 1988, 44(23), 7047-54.

The scope of the Michael reaction of L-ascorbic acid (I) was explored by its application of 2-cyclohexene-1-one and 2-cyclopenten-1-one, resp. unexpected acid catalysis wad discovered with the reaction. The configurations of the oxocyclopentyl derivs. on C-3' were detd. by X-ray crystallog. of α-II (n = 2) and α-II (n=1). II were found to be biol. active.

15. -,-, DETERMINATION OF

Dickson, E. Leslie, Svehla, Gyula. Determination of molybdenum by the catalyzed peroxy acetic acid -iodide-ascorbic acid, reaction. Anal. Chim. Acta. 1982, 139, 117-26.

A new catalytic method for the detn. of 0-10 ppm MO is described. MO catalyzes the peroxyacetic acid-KI-ascorbic acid Landolt reaction at pH 4.2. The rate is monitored by potentiometry, and results are evaluated from a calibration graph. Optimal conditions for the detn. are discussed and interferences described. The stolchiometry mechanism and kinetics of both the uncatalyzed and the catalyzed reactions were investigated, and the rate consts. (for 20°) as well as the entropies and enthalpies of activation of both the uncatalyzed and the catalyzed reactions are reported.

16. -,-, OXIDATION - EFFECT OF

Kawamura, Mami; Hirami, Yoshihiko. Inhibitive action of some water soluble vitamins against catalytic oxidation of ascorbic acid. The effect of pyridoxamine and folic acid. Kochi Joshi Diagakukiyo, Shizen Kagaku-hen. 1989, 37,25-37.

Several water-sol. vitamins except thiamine were examd. for the inhibition against the catalytic oxidn. of L-ascorbic acid (I). Pyridoxamine (II) and folic acid (III) showed high inhibitive action. It was found in more detailed studies that the inhibitive action of II could be expressed by a linear equation and that the inhibitive

action of III was due to a catalytic reaction with slow activation and could be approx. expressed an exponential equation. The reaction between the concs. of II. and the rate const. of catalytic oxidn. of I was also investigated. A max. inhibitive effect by II was obtained at pH 5.89.

17. -,-,- ESTIMATION

Baker, Warren L.; Goode, Jennifer; Cooper, Lynne. Estimation of hydrogen peroxide formed and residual ascorbate in copper catalyzed oxidation reaction of ascorbate at pH 7. Mikrochim. Acta. 1992, 106(3-6), 143-52.

A fluorescent method has been developed for detn. of ascorbic acid concns. The method involves treatment of the ascorbic acid with Cu (II) and treating the hydrogen peroxide formed with horse radish peroxidase in the presence of P-hydroxyphenylacetic acid, to form a fluorescent p-hydroxyphenylacetic acid dimer. The reaction is suitable for anal. of concns in the range of 50 μM to 4 mM ascorbic acid solns. and can be used for anal. of pharmaceutical prepns. but is unsuitable for anal. of ascorbic in prepns. derived from natural sources. By using a slight modification of the anal. technique it is possible to measure the amt. of hydrogen peroxide formed and the residual concs. of ascorbic acid in solns. treated with varying amts. of copper ion.

18. CHANGE, BIOCHEMICAL - VITAMIN E - DEFFICIENCY EFFECT OF

Chen, Linda H.; Thacker, Richard R. Effect of ascorbic acid vitamin E on biochemical changes associated with vitamin E deficiency in rats. Int. J. Vitam. Nutr. Res. 1987, 57(4), 385-90.

Weanling male sprague-Dawley rats were fed a vitamin E and C free basal diet with or without supplementation of 100 IU vitamin E/Kg diet. After 20 wK, the vitamin E deficient rats were divided into 4 groups, 6 in each group, and received supplemental ascorbic acid and/or vitamin E by tube feeding daily for 7 days : group I 30 mg ascorbic acid/100 g body wt., group II. 0.03 mg RRR- -to-Copheryl acetate/100 g body wt., group III 30 mg ascorbic acid and 0.03 mg RRR- -tocopheryl acetate/100 g body wt., and group IV placebo. Vitamin E deficiency significantly increased erythrocyte (RBC) spontaneous hemolysis, liver thiobarbituric acid (TBA) value.

Tube feeding both ascorbic acid and vitamin E showed simlar paratial reversal effect as feeding vitamin E alone on all the parameters stated above. The results suggested that ascorbic acid may spare the metab. of vitamin E and partially reverse. The changes in some of the biochem. parameters characteristic of vitamin E deficiency.

19. CHEMICAL COMPOUNDS - PROPERTIES, REDOX-EFFECT OF

Ogonski, Tadeusz. Redox properties of compounds containing -ketoendiolic system in the molecule. Pol. Tyg. Lek.

1991, 3617-35.

Effects of pH, ionic strength, and temp. on the dissocn. degree and redox properties of ascorbic acids were investigated. Dissocn. consts and normal oxidn. redn. potentials were detd. for L-, D-iso-, D-gluco-, and D-gulacto-ascorbic acids. The second order rate consts. in the reaction of ferricyanide redn. were estd. for the acids and for D-xylo- and L-arabino-ascorbic acids. The relation between the ionic strength and the reaction rate const. was exemplified by the redn. of cytochrome C by L-ascorbic acid. The redox properties of the studied compds. were closely assocd. with their acidity.

20. CHEMISTRY-ORGANIC-DERIVATIZATION-ADVANCES

Andrews, Glenn C.; Crawford, Thomas. Recent advances in the derivatization of L-ascorbic acid. Adv. Chem. Ser. 1982, 200 (Ascorbic Acid : Chem., Metab., USes) 59-79.

A survey of work since 1975 on the derivatization of ascorbic acid is reviewed from the perspective of the org. chem. of ascorbic acid (75 refs).

21. CHLOROBROMINE-B-OXIDIMETRIC TITRANT-ANALYSIS

Usha, B.N.; Rangaswamy; Yathirajan, H.H. Some analytical applications of chlorobromamine-B. Talanta. 128, 29(9), 803-4.

Chlorobromamine-B is proposed as an oxidimetric titrant in AcOH for potentiometric titrn of hydrazine

sulfate, ascorbic acid, hydraquinone, semicarbazide hydrochloride, $Fe(CN)_6^{4+}$, Sb(III), SCN^-, Thiosemicarbazide, isoniazid, indigo carmine, oxime, and Tl (I).

22. CHROMETOGRAPHY-AMPEROMETRY

Uchiyama, Shunchi; Umetsu, Yoshihiro. Concentration-step amperometric sensor of L-ascorbic acid using cucumber juice. Anal. Chim. Acta. 1991, 255(1), 53-7.

L-Ascorbic acid was detd. by concn.-step amperometry using a thin layer of carbon felt impregnated with cucumber juice as a enzyme soln. of ascorbate oxidase. The dil. fruit juice was added on top of the carbon felt and the decreased current peak caused by the enzymic reaction was measured. The cucumber juice was prepd. by filtration and centrifugal sepn. The peak current was proportional to the concn. of L-ascorbic acid in the concn. range $2.5x10^{-4}$-$1.6x10^{-3}$ M. The results obtained were in fairly good agreement with those obtained by liq. chromatog.

23. -, DETECTION-DETERMINATION OF

Borechert, Clemens; Krueger, Eckhard. Simultaneous determination of ascorbic acid, saccharin, and preservatives in berry by ion-pair chromatography on RP phases and gradient elution. Monatsschr. Brauwisc. 1989, 42(11), 438-42.

Ascorbic acid, saccharin, benzoic, salicylic, and sorbic acids, and the Me, Et, Pr, and Bu esters of P-hydroxy benzoic acid were detd. in beer by ion-pair HPLC on

Lichrospher RP-8 and RP-18, with gradient elution and UV detection. Samples were injected directly following decarbonizing detection limits were 2-5 ppm.

24. -, METHODS-ACIDS, ORGANIC-DETERMINATION OF

Maslowska, Joanna; Kucharska, Urszula. New method of determination of organic acids on chromatograms with horse radish peroxidase. Chem. Anal. 1988, 33 (4), 567-71.

Development of paper chromatograms using peroxidase and benzidine, p-toluidine, gallic acid or pyrogallol with H_2O_2 as substrates was applied in the detn. of org. acids exhibiting activating or inhibiting effects upon the enzyme activity. The limit of detection for lactic acid ascorbic acid was 2 ug, for oxalic and glutaric acids - 5 ug, for tartaric acid - 3µg and for tannic acid -4 µg.

25. -,-, COMPOUNDS

Bui, Nguven, Mai Huong. Ascorbic acid and related compounds. Chromatogr. Sci. 1985, 30, 267-301.

Methods are discussed for the detn. of ascorbic acid and related compds. in food, pharmaceutical products, body fluids, and plant and animal tissues by chromatog., methods, esp. liq. chromatogr., paper chromatog., TLC, and gas chromatog.

26. -,-, DETERMINATION OF

Wang, Xiaoying; Liao, Ming Long; Hung, Tsui Hwa; Seib, Paul A. Liquid chromatographic determination of L-ascorbate-2-

polyphosphate in fish feeds by enzymic release of L-ascorbate. J. Assoc. off. Anal. Chem. 1988, 71(6), 1158-61.

An accurate method was devised to assay L-ascorbic-2-polyphosphate esters (AsPP) in fish feed by phosphatase digestion followed by detn. of released L-ascorbic acid (ASA). Compressed yeast and dithiothreitol are added to the phosphatase reaction mixt. to give 95-100% recovery of ASA, which is quantitated by reverse phase liq. chromatog. (LC) or all tech C-18 with electrochem. detection. Chromatographies of all feed digests showed base line resoln. of ASA. In 3 feeds to which 75-125 ppm. ASA equiv. in the form of ASPP were added; the assay procedure gave 98-100% recovery of ASA.

27. -,-, VARIANTS-ANALYSIS

Romero Revuelta, Juan; Mesa Crespo, Dora; Pino Alea, Jorge. Study some variants of the method for ascorbic acid determination with 2,4-dinitrophenylhydrazine. Rev. Cubana Farm. 1982, 16(1), 82-6.

Detn. of ascorbic acid (I) 50-81-7 by the colorimetric methods of Roe and Kuether (1943), based on the reaction of I with 2,4-dinitrophenylhydrazine (II) 119-26-6 is more accurate and more sensitive than by the chromatg. Colorimetric (II reagent) and by chromatog-visual methods. Thus, this method is recommended for the detn. of I, when the sample analyzed has a low reducing sugars content.

28. -, OXIDATION-POLAROGRAMS

Kimoto, Eiji, Tanaka, Hidehiko; Yamauchi, Hisasho; Toki, Chie; Tsuyama, Takeshi; Taura, Hidetomo; Kurihara, Hirondo. Studies on the oxidation products of ascorbic acid III. Polarographic studies. Fukuoka Diagaku Rigaku Shuho. 1989, 19(1), 31-6.

Ascorbic acid was oxidized in EtOH contg. NaOH. DEAE-Sepharose Column. Chromatog. was used to isolate 4 oxidn. products. Polarog. and NMR and identified one of the products as erythro-ascorbic acid. The polarograms of ascorbic acid, dehydroascorbic acid, and their oxidn. products are described.

29. -, PAPER-FLUIDS CERVICULAR PLASMA HUMAN

Meyle, J.; Kapitza, K. Assay of ascorbic acid in human crevicular fluid from clinically healthy gingival sites by high performance liquid chromatography. Arch. Oral Biol. 1990, 35(4), 319-23.

The vol. of fluid on filter paper strips was measured with a periotron, eluted and the ascorbic acid measured by chromatog. In preliminary expts, pre-impregnation of the strips with citric acid increased the recovery of std. ascorbic acid from 37 to 89% and significantly reduce loss of water from the strips over a 3 min period. Samples of crevicular fluid were then collected from clin. healthy gingival sites of 21 healthy volunteers using pre-impregnated strips and assayed for ascorbic acid conc., together with

samples of blood plasma. The mean ascorbic acid concn. in gingival crevicular fluid (207.3 μ mol/L., SD : ± 81.8) was significantly higher ($p < 0.001$) than the corresponding plasma concn. (mean 72 μ mol/L; SD : ± 23.3).

30. -, PRECONCENTRATION ANALYSIS

Das, N.R. Preconcentration of rare earths in geological materials with ascorbic acid for their neutron activation analysis. J. Radio. anal. Nucl. chem. 1988, 122(1), 13-18.

The potential use of ascorbic acid as a complexing reagent in the sepn. and preconcn. of rare earth elements (REE) in geol. materials in a suitable solid matrix was demonstrated. Traces of REE from some USGS std. rock samples viz. GSP-1, G-2, AGV-1, and PCC-1, have been sepd. after acid dissoln. in two ways : (1) by ion exchange chromatog. on Dowex 50x8 column and Na ascorbate as eluent and (2) by direct complexation with ascorbic acid under specific exptl. conditions. The sepd. REE were copptd. with the noisotopic diluent, calcium fluoride, before neutron activation anal. Radiometric detns. showed that the over all recovery of REE in both cases was practically quant.

31. -, REACTION LIQUID-ELECTROCHEMICAL

Karp, Stewart; Ciambra, Charles M.; Miklean, Saul. High performance liquid chromatographic post column reacting system for the electrochemical detection of ascorbic acid and dehydro ascorbic acid. J. Chromatogr. 1990, 504(2), 434-40.

A post column reaction system is described for the electrochem. detection of ascorbic acid (AA) and dehydroascorbic acid (DHAA), individually and in their mixt., by HPLC. The reaction is based on the redn. of DHAA with excess dithiothrietol and reaction of excess dithiothrietol and reaction of excess dithiothrietol with N-ethylmaleimide. The maleic phase was 0.010 M $HClO_4$. The relative std. deviation was 3% (n=6) for AA and 4% (n=4) for DHAA. The method was applied to a urine sample.

32. -, SEPARATION

Coustard, J.M.; Sudraud, G. Separation of ascorbic acid isoascorbic acids by reversal-phase ion-pair chromatography. J. Chromatogr. 1981, 219(2), 338-42.

Ascorbic acid isoascorbic acids were sepd. by ion-pair chromatog. on single columns packed with Lichrosorh RP-8, or RP-18 bounded silica, by eluting with a buffered 9:1 MeOH-H_2O mixt. contg. cetyltrimethylammonium as counterion. Detection was by UV absorption at 264 nm. The compds. were sepd. and detected in lemon juice, a hamadditive mixt., a multivitamin syrup, and an ext. from ham.

33. -, SOLUTIONS, AQUEOUS-ANALYSIS

Archer, Alan W. Stability of aqueous solutions of ascorbic acid prepared for analysis of high performance liquid chromatography. J. Assoc. Public Anal. 1981, 19(3), 91-3.

Ascorbic acid in aq. soln. with Cu and in dil. orange juice was stabilized for high-performance liq. chromatog.

detn. by adding EDTA (di-Na salt) or EDTA (di-Na salt) and citric acid. In aq. soln. with 0.8 μg mL^{-1} Cu and 20 ug mL^{-1} EDTA, 98.3% of the original 40 μg mL^{-1} ascorbic acid was present after 24 h, vs. none without EDTA. Dil. orange juice contained 94.4% of its original ascorbic acid concn. after 24 h with added EDTA and citric acid, vs. none with no added stabilizer or with citric acid alone.

34. -, TEMPERATURES, SOLVENT-PERFORMANCE

Klaus, R. Significance of mobile phase temperature in high performance thin layer chromatography demonstrated by some practical examples. J. Chromatogr. 1984, 283, 347-60.

Effects of developing solvent temp. on chromatograms were dmonstrated by examples. of ascorbic acid domain residue anal. of tatoxins. in milk exts., and polycyclic arom. hydrocarbon in water. The temp. ranges from -20 to +23° was studied.

35. -, VITAMINS-ANALYSIS

Goodney, David E. Analysis of vitamin C by high pressure liquid chromatography. J. Chem. Educ. 1987, 64(2), 187-8.

A Lab. expt is described for the HPLC anal of ascorbic acid that can be used with a variety of beverages. The HPLC anal. uses isocratic elution and UV absorbance detection. The extent of oxidn. of ascorbic acid in a sample is detd. by reducing. The dehydroascorbic acid and measuring the resulting total scorbic acid.

36. -, WOOL-TREATMENT

Thomas, Helga; Virnich, Alfred. After chrome dyeing of wool. Schriftenr. Dtsch. Wollforschungsins. (Tech. Hochsch. Aachen) 1991, 108 (Aachener Textiltag, 1990), 605-14.

The effects of pH and fiber pretreatment on Cr loading in after chrome dyeing of wood are discussed. The Cr^{6+} loading in the end bath increased with increasing pH of the after chrome bath. The dye itself also affected the residual Cr content in the post treatment bath. The use of ascorbic acid to reduce the Cr^{6+} in the bath is also discussed. Chromation was slower in Hercosett wool than regular wool, and the difference was attributed to ionic interactions with the cationic polymer.

37. COBALT-ANALYSIS-PFEIFFER EFFECT

Ahmad, Nasir, John, Earnest Obed; Munir, Chrisly. The pfeiffer effect studies in some mixed ligand complexes of cobalt (III). J. Chem. Soc. Pak. 1987, 9(4) 479-85.

The Pfeiffer effect was studied in a series of 13 $[Co(AA)_3^{n+}]$ and $[Co(AA)_2BB]^{n+}$ (AA and BB = 1,10-phenanthroline,2,2-bipyridine (bpy), oxalate or carbonate), cis-$[Co(bpy)_2X_2]^+$ (X = Cl, or NO_2) and Cis-$[Co(phen)_2Cl]^+$ ions in presence of (+)-cinchonine hydrochloride and (+)-tartaric acid. Two new chiral environment compds, i.e. (+)-ascorbic acid (-)-lysine also induce this effect in a few complexes. The effect is used to correlate the abs. configurations of these complexes with that of std. compds. like A-$K_3[Co(C_2O_4)_3]$.

38. COMPOUNDS-ACETATES-PMR, STUDY OF

Jagannathan, N.R.; Srinivasan, R. Wide-line NMR studies on organic and biomolecules ; Part IX-PMR study of some acetates and related compounds. Indian J. Pure Appl. Phys. 1984, 22(8), 484-8.

Wide line PMR studies are reported of acetates Hd, Ca, Al, and Ba in the unhydrated forms and of Pb, Mg, Cd, Zn, Mn, Co, Ni and Cu in the hydrated forms. Studies on 1-naphthaleneacetic acid, 2-naphthyloxacetic acid and L-ascorbic acid are also reported. In all the acetates Mn group reorientationis present even at low temp. For the hydrated acetates flip motion of the water protons is present. The lattice is essentially rigid in the case of 1-naphthaleneacetic acid and 2-naphthalene-acetic acid and ascorbic acid.

39. -, HYDROXY-REAGENT - USE OF

Shukla, I.C. Determination of certain hydroxy compounds with the use of cerium (IV) reagent. Asian J. Chem. 1991, 3(1), 25-9.

Aliph. alcs, aliph. diols, and ascorbic acid were detd. by addn. of excess $(NH_4)_2$ $Ce(NO_3)_6$ and titrn. of the unconsumed Ce(IV) with 0.1 M Fe(II) using ferroin as indicator. Ascorbic acid was detd. in 4 pharmaceutical products. Products of oxidn. of the analytes were identified to established reaction paths. The hydroxy and tetrahydroxy compds. could not be detd. by this method.

40. CONTENTS-SEEDLINGS-GROWTH CHILLING STRESS-EFFECT OF

Zeng, Shaoxi; Wang, Yirou; Liu, Hongxian. The effect of chilling stress on the content of ascorbic acid in rice seedlings. Zhiwu Shengli Xuebao. 1987, 13(4), 365-70.

The ascorbate content in rice seedlings decreased with the time of the exposure to chilling temp. The change of the content of GSH was parallel with that of ascorbic acid. There was a neg. correlation between the ascorbate content and the leakage of leaf electrolytes. The ascorbate content decreases and malonyldialdehyde content increased in rice seedlings as the temp. decreased. The contents of ascorbate and malonyl dialdehyde were different in rice seedlings recovered at various light in tensities after chilling treatment. The redn. of ascorbate content induced by low temp. was inhibited in rice seedlings by pretreatment with the antioxidants glutathione, L-cysteine and mercapto-ethanol. The role of ascorbic acid on chilling resistance in rice seedlings is discussed.

41. -,-,-, RAPHANUS SATIVUS-CHANGES IN

Kushibe, Masahisa; Hunahashi, AKIKO. Changes in ascorbic acid contents in Raphanus sativus seedlings during growth and storage. Nara Kyoiku Diagakukiyo, Shizen Kagaku. 1989, 38(2), 26-6.

The content of total ascorbic acid (I) in R. sativus seeds was 0.11 mg/g fresh wt. The level of I content increased after onset of germination and reached max. (0.55 mg/g)

of 6 days after inhibition. The I content in cotyledons was always higher than that in the hypocotyl. Degrdn. of I was obsd. when 7-day old seedlings were stored at 40° or 20° for 12 days. This degrdn. seems to proceed non enzymically, since the level of ascorbic oxidase activity is extremely low (0.11 ug of I oxidized/min/g).

42. CRYSTALLIZATION-SOLUTIONS, AQUEOUS EFFECT OF

Matynia, Andrzej; Wierzbowska, Boguskawa; Kot, Garoslaw. Effect of methanol on the crystallization of L-ascorbic acid. Kryst. Przem., Krajowe Symp., Mater. Konf. 1986,56-64.

Inst. Chem. Nicorg. Gliwice, Pol. Crystn. of L-ascorbic acid (I) from aq. solns. in the presence of MeOH gave significantly bigger crystals than crystn. in the absence of MeOH. The concn. of I soln. should be > 40% (preferably 45-50%) and the concn. of MeOH should not be > 30% (preferably 20-30%). Max. under cooling and supersatn. of aq. MeOH solns of I were higher than the corresponding values for I solns. not contg. MeOH. It was recommended to cool the solns. at rates < 30°/h.

43. -, WATER SYSTEM-ISOPROPANOL

Matynia, Andrezej; Wicrzbowska, Boguslawa. Crystallization study in the ascorbic acid isopropanol-water system. Chem. Stosow. 1989, 33 (1), 113-26.

Soly. and d. of an ascorbic acid (I)-iso-prOH(11)-H_2O system was studied at 308-358 K, I concn. 30-50 wt.%

and II conc. 0-40 Wt.%. A correlation equation was derived Max. supercooling (15-41 K) decreased with increasing concn. of I. Larget I crystats. ~0.7 mm mean diam., were obtained from solns. contg. 50% I and 20% II, when cooling rate was ≤ 8.33×10^{-3} K/S.

44. CRYSTALLOGRAPHY-ION'S EXCHANGE-ROLE OF

Sussangkarn, Kawporn; Fodor, Gabor; Strope, Douglas; George, Clifford. New furo 3,2-b furans derived from L-ascorbic acid. Heterocycles. 1989, 28(1), 467-75.

The role of L-ascorbic acid (I) as a Michael carbanion donor has been extended to a cyclic enedione-2,3,-dihydro-benzoquinone (II). Although II is a desmotropic form of hydroquinone it reacted with I as an α,β -unsatd. mono-ketone giving rise to 2-(1',4'-diketo-2'-cyclohexyl)-3-keto-L-gulonolactone-3,6-cyclohemiketal, which, inturn, was stabilized as the -3,1-cyclohemiketal (III). The latter structure was proven by X-ray Crystallog.

45. -, REACTIONS FORMATION

Eger, Kurt; Folkers, Gerd; Zimmerman, Werner; Schmidt, Rainer; Hiller, Wolfgang. Unexpected formation of a hetero-cyclic spiran in the Michael reaction of ascorbic acid with acrolein. J. Chem. Res., Synop. 1987, (9), 277.

Michael addn. of ascorbic acid to $H_2C{:}CHCHO$ in aq. soln. gave the cryst. hydrate, of the heterocyclic spiran I. whose structure was detd. by X-ray crystallog. and MNDO

calcns. Michael addn. in EtOH or azeotropic distin. of I gave the anhyd. compd. II. Complex mutarotations occur both I and II.

46. -, SOLUTIONS - FORMATION

Iwamoto, Kuzutoshi; Mitomo, Shunichi; Seno, Manabu. Rhythmic crystallization of ascorbic acid precipitated from its methanol solutions. J. Colloid Interface Sci. 1984, 102(2), 477-82.

As an example of the formation of dissipative structures, the appearance of rhythmic crystn. during pptn. of ascorbic acid from its methanol soln. is reported. In this system, regular concentric rings of large and small pitches were obsd. A qual. explanation about the mechanism of rhythmic crystn. based on Mullins-Sekerka instability is proposed.

47. -,-, METHODS

Matynia, Andrzej; Wierzbowska, Boguslawa; Bechtold, Zdzislaw. Means of producing crystallized vitamin C from water-methanol solutions. Kryst. Prezem., Krojowe Symp., Mater. Konf. 1986, 139-47.

Inst. Chem. Nieorg. : Gliwice, Pol. A method for the prepn. of crystd. vitamin C is based on the dissoln. of tech-grade vitamin C in a water-MeOH soln. at 343-346 K, reliminary purifn. with activated C, and crystn. of ascorbic acid from the purified soln.

48. DERIVATIONS PREPARATIONS

Suskovic, Bozidar. Preparation of 6-amino-6-deoxy derivatives of ascorbic and iso-ascorbic acid. Croat. chem. Acta. 1989, 62(3), 537-44

6-Amino-6-deoxy derivs. of ascorbic acid isoascorbic acid were prepd. by a series of nucleophilic substitutions on the C_6 atom. In the case of isoascorbic acid, the nitrogen in position 6 was introduced via the 5,6-epoxy deriv. of isoascrobic acid.

49. DIALYSIS-ELECTRODES, GRAPHITE

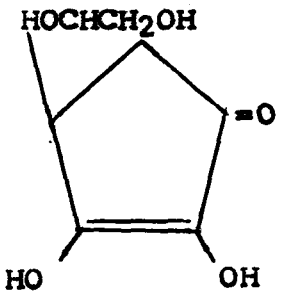
Kinoshita, Hideaki; Yoshida, Daisuke. A dialysis membrane-covered graphite paste electrode as a sensor for ascorbic acid. Nippon Kasei Gakkaishi. 1991, 42(11), 979-82.

A graphite paste electrode covered by dialysis membrane was applicated to the rapid amperometric detn. of ascorbic acid (I) even in a soln. contg. such proteins as serum albumin. Anodic current at a const. potential (0.2-0.5 V) was linearly increased with increasing concn. of I in a range of 1 uM to 1 mM. The interfering effect of coexisting materials such as depamine, uric acid, homovanillic acid, and glutathione was lowered by adjusting a test soln. and an electrode potential to pH 3-4 and 0.25-0.40 V, resp.

50. DISEASES-ATHEROSCLEROSIS - EXCRETION-SMOKING

Sulochana. G.; Arunagiri, R. Smoking and ascorbic acid (vitamin C) excretion. Clinician. 1981, 45(5), 198-201.

Ascorbic acid (I) [50-81-7] excretion in urine was significantly elevated in 50 healthy habitual smokers after smoking 5 cigarets (45 minto 1h). Thus cigaret smoking definitely increases the excretion of I causing tissue depletion leading to increased risk of getting atherosclerosis and related diseases.



I

51. DRUGS-REACTIONS - RATE OF

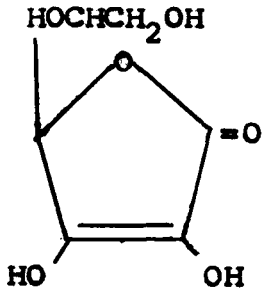
Evans, David J., Green, Michael. The rate of reduction of cis-, cis, trans-bis (isopropylamine) dichlorodihydroxoplatinum, CHIP, the anti-cancer drug by ascorbic acid. Inorg. Chem. Acta. 1987, 130(2), 183-4.

Cis, Cis, Trans- [Pt iv $(NH_3)_2Cl_2(OH)_2$] reacts reversibily with ascorbic acid to give dehydroascorbic acid and mainly cis-[Pt II $(NH_2\text{-iso-Pr})_2Cl_2$]. The rate const. for the forward reaction is 0.584 $M^{-1}x^{-1}$ at 37.0°. Activation parameter were detd.

52. -, SUCROSE STABILITY OF

Trivedi, B.M.; Trivedi, G.M. Studies in stability of ascorbic acid in selected sucrose based vehicles. Part II. East. Pharm. 1981, 24 (284), 191-3.

The most stabilic oral formulation of ascorbic acid (I) [50-81-7] is syrup base included glycerin [56-81-5] (equiv. amt. to syrup), Propylparaben [94-13-3] (1:2000), and EDTA [60-00-4] (0.01%). The half of this formulation was 1701 and 678 days at 5 and 37°, resp. In the presence of O the half life of I was decreased from 917.7 to 225.6 and from 441 to 153.4 days at 5 and 37° resp. Thus, the selection of good quality sugar in the syrup, addn. of a light and high temp. and filling of the container to the brim, are all necessary precautions to insure the stability of I formulations.



53. -, TECHNIQUES. AIR SUSPENSION

Shukla, A.K., Verma, K.C. Microencapsulation of ascorbic acid by air suspension technique and formulation of tablets. Indian Drugs 1983, 21(3), 100-6.

Ascorbic acid [50-81-7] granules contg. 2% poly (vinyl pyrrolidone) [9003-39-8] as the binder and encapsulated with glyceryl tristearate [555-43-1] gave tablets with the highest shelf life as compared to tablets prepd. from granules coated with stearic acid [57-11-4], polyethylene glycol [24322-68-3] Et cellulose [9004-57-3], Silicone oil, shellac, or cetyl alc. [36653-82-4]. The solvent [EtOH (64-17-5], benzene [71-43-2] or CCl_4

[56-23-5] for the coating material also affected the coating process of the granules. The granules were coated by the fluidized bed technique under air pressure of 1 kg. cm^{-2} and 55^{o}.

54. ELECTROCATALYSIS-ELECTRODES-POLYMER FILM

Kuo, Kuo, Nan; Murray, Royce W. Electrocatalysis with ferrocyanide electrostatically trapped in an alkylamine siloxane polymer film on a platinum electrode. J. Electroanal. Chem. Interfacial Electrochem. 1982, 131, 37-60.

A procedure is described whereby thin films of an alkylamine-siloxane polymer can be formed on Pt electrode surfaces. The polymer films strongly partition ferrocyanide ion from aq. pH 3.2 electrolyte and electrochem. reaction of the trapped ferrocyanide can be disol. Kinetic of 2 electrolytic reactions are described. One is the electron self exchange between neighbour ferrocyanide and ferricyanide ions by which electrochem. charge becomes transported through the multimol. layer film. The 2nd is the oxidn. of ascorbic acid by ferricyanide electrogenerated in the film. Both reactions exhibit rate consts. in the polymer film which are larger than those of the analogous homogeneous soln. reaction.

55. ELECTROCHEMISTRY-ELECTRODES-ADSORPTION-DETERMINATION OF

Korell, Ulrich; Lennox, R. Bruce. Determination of ascorbic acid using as organic conducting salt electrode. Anal. Chem. 1992, 64(2), 147-51.

An organic conducting salt electrode based on tetrathiaful valance (TTF)-P-tetra cyanoquin dimethane (TCNQ) was used for the amperometric determination of ascorbate levels in aq. samples. The current/concn. relationship was linear upto approx. 50 mM ascorbate at 100 mV (Ag/AgCl). At more oxidizing potentials (-75 and -50 MV) the signals were larger but the linear dependence evolved into a square root dependence at approx. 2.5 mM ascorbate. Steady-state-signals were obtained within 10 S. Optimum results were obtained between pH -7.5 and 9.0 and at high buffer concn. The TTF-TCNQ electrode was used to determine the ascorbate content of apple juice. The datas were in reasonable agreement with results from a spectrophotometric based com. test-kit. Neither adsorption nor background reductant interference were observed. Using a membrane electrode sulfite and dopamine are not electro oxidized by the electrode at -75 mV and therefore are not interferents.

56. -,-, CATALYSIS

Cai, Qihua; Yang, Renwu. Continuous determination of molybdenum (VI) and iron (III) with iodide ion selective electrode. Fenxi Huaxue. 1988, 16(11), 1021-3.

The Landolt reaction is applied to the detn. of Mo(VI) and Fe(III) by means of its catalytic effect on the hydrogen peroxide-iodide-ascorbic acid reaction. The iron (II) is masked with EDTA to det. the content of Mo(VI),

and the amt. of Fe(III) is obtained by subtraction from the total amt. of Mo and Fe. Mo (4-10 μg) and Fe (2-10 ug) were detd. in synthetic samples with relative std. derivations of 4.0-11.2%.

57. -,-,-, MEASUREMENTS

Zhong, Chuanjian; Wang, Zhongquan; Tian, Zhaowu. Electrocatalysis of electrodes coated with conducting polypyrole films-electrocatalytic oxidation of ascorbic acid. Gaodeng Xuexiao Huaxue Xuebao. 1988, 9(1), 62-6.

Electrocatalytic oxidation of ascorbic acid (I) in acidic solns. was studied at electrodes coated with conducting polypyrrole (II) films shifts of 200-300 mV for the oxidn. potential of I at the polymer-coated electrodes were obsd. by cyclic voltammetry. Through measurements of Tafel plots, the mechanism of electrocatalytic oxidn. of I is discussed. With the help of XPS and in-situ ESR spectrum, interaction between electrochem. oxidized II and I surface species are also discussed. A coupling of electron-transfer mediated catalysis and chem. catalysis of II is suggested.

58. -,-, CHLOROPHYLL MEASUREMENT

Zhou, Ruiling; Han, Yunfu; Yang, Yuguo. Study on the chlorophyll-a/poly (vinyl alcohol) Sandwich solar cell. Ganguang Kexue Yu Kuang Huaxue. 1991, 9(3), 229-32.

A chlorophyll-a (CPA)/polyvinyl alc. (PVA) Sandwich cell has been studied. The CPA electrode was prepd. by

electrodeposition. The PVA membranes were modified by doping of hydroquinone (H_2Q), ascorbic acid (ASC) and Na salt of EDTA, resp. The photoelec. properties of the Sandwich cell were measured carefully showing that the introduction of H_2Q or ASC to PVA membrane increased the photocurrent of a CPA cell.

59. -,-, DETERMINATION OF

Kumbhat, S.; Rawat, C.; Sharma, P. On line electrochemical determination of ascorbic acid. J. Indian Chem. Soc. 1990, 67(7), 617-18.

A simple, fast, and sensitive method is described for the detn. of ascorbic acid by HPLC with electrochem. detection on a glassy carbon electrode. The Ag/AgCl electrode was used as the ref. electrode and the detector potential was set at 400 mV. The detection limit is 0.5 µg/mL ascorbic acid in the Britton-Robinson buffer soln. The retention time is 3.4 min. The method was successfully in detn. of vitamin C in com. multivitamin tablets.

60. -,-, DIFFERENCES VOLTAMETRIC

Falat, Ladislav; Cheng, H.Y. Voltammetric differentiation of ascorbic acid and dopamine at an electrochemically treated graphite/epoxy electrode. Anal. Chem. 1982, 54(12), 2108-11.

Electrochem. pretreatment of a graphite/epoxy microelectrode allows voltammetric differentiation of dopamine

from ascorbic acid in vitro and in viva. The optimal procedure involved square wave cycling between-5 and +7 V. The pretreatment conditions are different from those for pyrolytic graphite fiber electrodes, but the results are comparable. With this procedure, the electrode surface becomes much rougher, the residual current increases, and the voltammetric peak of ascorbic acid shifts to more neg. potentials (-0.07 V Vs SCE in PH 7.4 buffers) while the dopamine peak remains virtually the same (+0.15 V). Strong adsorption of dopamine on the modified electrode surface and decrease in sensitivity for ascorbic acid are also obsd.

61. -,-, ION EXCHANGE-CATALYSIS

Mao, Huangu; Pickup, Peter G.J. Electronically conditive anion exchange polymers based on polypyrrole. Preparation, characterization, electrostatic binding of ferrocyanide and electrocatalysis of ascorbic acid oxidation. J. Electroanal. Chem. Inferfacial Electrochem. 1989, 265 (1-2), 127-42.

Electronically conduction anion exchange polymers were prepd. by the electrochem. polymn. of protonated and quaternized 3-(pyrrol-1-y(methyl)pyridine. The quaternized polymer was characterized by elemental anal. gravimetry, cyclic voltammetry, SEM, and cond. measurements. Its structure cond., and electrochem. are similar to those of other N-substituted polypyrroles.

62. -,-, MECHANISM

Lowry, John P.; O'Neill, Robert D. Homogeneous mechanism of ascorbic acid interference in hydrogen peroxide detection at enzyme-modified electrodes. Anal. Chem. 1992, 64(4), 453-6.

Calibrations for glucose at poly (O-phenylenediamine)/ glucose-oxidase modified Pt disk electrodes in the presence of and absence of ascorbic acid (AA) showed that the max. current response was substantially decreased by AA. Exptds. with solns. of H_2O_2 and AA indicate that this redn. is caused by a homogeneous redox reaction in which the H_2O_2 formed by the catalytic oxidn. of glucose is depleted by AA. Thus, although polymer modifications of enzymes electrodes have been used in the past to reduce the direct faradiac interference by AA in assays of a variety of substracts, this homogeneous process is still active, affecting the sensors response. These results suggest that H_2O_2-detecting sensors are not suitable for direct assays in biol. systems, such as blood and brain extracellular fluid, in which the concn. of AA is continuously changing.

63. -,-, MICROSCOPY

Wang, Joseph; Martinez, Teddy; Yaniv, Daphna R.; McCormick, Larry D. In situ characterization of electrochemically activated glassy carbon electrodes with scanning tunneling microscopy. J. Electroanal. Chem. Interfacial Electrochem. 1990, 278(1-2), 379-86.

The utility is demonstrated of scanning tunneling microscopy (STM) to characterize, in-situ, electrochem. activation processes on glassy C electrodes. The high-resoln. surface imaging provided by STM makes it a powerful tool in surface science. The effect of pretreatment on the surface properties of glassy C was examd. The surface roughness and connections with oxidn. of ascorbic acid hydrazine are described.

64. -,-, OXIDATION

Kulys, J.; Drungiliene, A. Electrocatalytic oxidation of ascorbic acid on chemically modified electrodes. Elektrokhimiya. 1990, 26(10), 1318-23.

The electrocatalytic oxidn. of ascorbic acid was studied in neutral buffered solns. on graphite electrodes modified with P-etracyanoquinodimethane ferrocene,1,1-dimethyl ferrocene or tetrathiafulvalene. The catalytic properties of modified electrodes were 80% after 2 mo of working. The electrocatalytic ability of electrodes was estd.

65. -,-,-

Valls, Maria J.; Feliu, Juan M.; Aldaz, Antonlo; Climent, Miguel A.; Clavilier, Jean. Electrocatalytic oxidation of L(+)-ascorbic acid on single crystal platinum surfaces modified by irreversibly absorbed bismuth. J. Electro and Chem. Interfacial Electrochem. 1989, 260(1), 237-44.

L(+)-ascorbic acid (vitamin C)(I), was studied as a possible electrochem. (I) sensor for monitoring biochem. species "in vitro" or "in vivo" because of its importance in many biolog. processes. The 1st results on the electrochem. oxidn. of I on Pt (100), (110) and (111) in aq. H_2SO_4 are presented.

66. -,-,-

Ormonde, Dymphna E.; O'Neill, Robert D. The oxidation of ascorbic acid at carbon paste electrodes. Modified response following contact with surfactant. Lipid and brain tissue. J. Electroanal. Chem. Interfacial Electrochem. 1990, 279 (1-2), 109-21.

The electrochem. characteristics of ascorbic acid and ferrocyanide were investigated at untreated, surfactant (Triton-X) treated and lipid (phosphatidylethanolamine) treated C paste electrodes (CPEs), at C powder electrodes, and at CPEs following contact with brain tissue. The results indicate that, following contact with brain tissue, pasting oil is removed (apparently by lipids present in the tissue) from the active surface of the electrode. Resistance and capacitance studies support this interpretation. Electron transfer at the resulting powder type surface is faster than at the original CRE, Leading to a shift in the oxidn. wave for ascorbic acid to lower potentials. Adsorption of substrate on the electrode is evident following, but not before, the treatments. Implications for

the development of chem. modified CPEs for use in vivo are discussed.

67. -,-,-, ANALYSIS

Feng, Derong; Qiu, Weizhong; Shang, Xueqin; Zhou, Wanli; Zhao, Xiaohua; Feng, Yunshui; Zhang, Dongyan. Rapid analysis of vitamin C by enzyme electrode. Zhongyo Yiyao Gongye Zazhi. 1990, 21(6), 261-3.

L-Ascorbic acid oxidase was immobilized on a cellulose membrane using glutaraldehyde, which was wrapped on to the tips of O_2 electrodes to create vitamin C selective electrodes. The relative std. deviation was 0.79% and a std. curve was linear for 10-1000 mg vitamin C/dt. vitamin C anal. by the S method is accurate, rapid, and simple and is useful for anal. of fermn. media.

68. -,-,-, KINETICS

Li, Fengbin; Dong, Shaojun. Electrocatalytic oxidation of ascorbic acid on prussian blue film-modified electrodes. Huaxue Xuebao. 1990, 48(7), 653-9.

The kinetics of Prussian blue (PB) film itself during the redox process and of the catalytic oxidn. of ascorbic acid (AH_2) on it have been studied in detail. The charge transfer diffusion coeff. Det in PB film is detd. as 2.62×10^{-10} cm^2 S^{-1}, using potential-step chromoamperometry, chronocoulometry and const. current chronopotentiometry. The rate const. of the cross-exchange reaction between AH_2 in soln. and the active centers in

PB film is measured in rotating disk electrode as 1.23×10^{8} $cm^{3}.mol^{-1}s^{-2}$. The catalytic reaction occurs only at the outer most part of the PB film and is first order to the bulk concn. of AH_2. The overall process can be limited by mass transfer in soln., by cross-exchange reaction at the film-soln. interface, by charge transfer with in film or by some kind of combination of them; with four kinetic subcases exptl. obsd. and analyzed.

69. -,-,-, POLYANILINE FILM

Dong, Shaojun; Song, Fayi. Electrocatalytic oxidation of ascorbic acid at Polyaniline film modified glassy carbon electrodes. Wuli Hauxue Xuebao. 1992, 8(1), 82-6.

A conducting polyaniline (PAn) film modified glassy carbon electrode was prepd. by electrochem. polymn. The electrochem. behaviour of ascorbic acid is aq. soln. at this PAn modified electrode was studied in detail. The exptl. results show that PAn film modified electrode has good electrocatalytic activity on the oxidn. of ascorbic acid in aq. soln. over a wide range of pH value, among which pH 4 is the optimum condition. The oxidn. process of ascorbic acid at PAn film electrode can be regarded as an EC catalytic mechanism. The kinetic process of the catalytic reaction was investigated by rotating disk electodes coated with PAn films. The rate const. of the catalytic reaction was evaluated. The catalytic peak currents are proportional to the concs. of ascorbic acid in the

range of $5x10^{-2}$-$1x10^{-6}$ mol L^{-1}. The PAn film electrodes give, very stable response for the oxidn. of ascorbic acid. The present investigation shows the possibility of using PAn film modified electrode for the detn. of ascorbic acid.

70. -,-,- VOLTAMETRIC

Kumbhat, Sunita; Kapoor, R.C. Voltammetric Behaviour of Ascorbic Acid at the DME. J. Indian Chem. Soc. January 1987, 64(1), 20-23.

Differential pulse polarographic study of the anodic oxidation of ascorbic acid has been made over pH range 3-11 in Britton-Robinson buffer medium. The nature of the limiting current has been evaluated by observing the influence of mercury pressure on the wave height of the de polarograms. The number of electrons involved in the electrode process was confirmed by varying the pulse amplitude and noticing the $W_{1/2}$ in the DP polarograms. In acidic medium, the electrode reaction involves reversible oxidation of ascorbic acid to dehydroascorbic acid. Two peaks appear in between the acid anion and its hydrated form. Both the forms get oxidised at different potentials.

71. -,-,-,-

Wring, Stephen A.; Hart, John P.; Birch, Brian J. Voltammetric behaviour of ascorbic acid at a graphite-epoxy composite electrode chemically modified with cobalt phthalocyanine and its amperometric determination in multivitamin preparations. Anal. Chim. Acta. 1990, 229(1), 63-70.

Cyclic voltammetry was used to investigate the electrochem. behaviour of ascorbic acid at a C-epoxy composite electrode modified with the electron mediator cobalt phthalocyanine. The modified electrode reduced the over potential necessary for the oxidn. of the vitamin by approx. 150 mV to 0.21 V Vs. the SCE, the process was dependent on the pH of the supporting electrolyte, but independent on ionic strength over the range studied. The relative std. deviation (r.s.d.) of the peak heights of the cyclic voltammograms was 0.81% for a $1x10^{-4}$ M ascorbic acid soln. The optimum supporting electrolyte was 0.05 M phosphate buffer (pH 5).

Amperometry in stirred solns. was then done of an applied potential of +0.25 V. The alimit of detection was 0.65 mg/mL and the calibration graph was linear in the range 175-50 ug/mL. The method was used to det. ascorbic acid concns. in single and multivitamin prepns., the recovery was 97.6% for the vitamin added to one prepn. The r.s.d. for the analysis in these samples was about 5%. For comparison, the vitamin was also detd. in these tablets using LC with UV detection at 254 nm; the correlation coeff. for the levels detd. was 0.9989.

72. -,-, POLYPYROLE FILM-MEASUREMENTS

Zhong, Chuanjian; Huang, Wenxiu; Tian, Zhaowu. ESR-electrochemical studies of electrodes coated with conducting Polypyrrole film. Huaxue Xuebao. 1989, 47(8), 783-7.

Electrodes coated with conducting polypyrrole film were studied in aq. solns. by in-situ ESR-electrochem. measurements. It was qual. shown that the spin concn. is directly dependent on the oxidn. state of polypyrrole. In transient processes, the formation of spins and their transformation to spinless structures were correlated with electrochem. charge injections. The exptl. results are explained interms of polaron and bipolaron formations in the electrochem. redox processes. ESR-electrochem. behaviours of the polymer-coated electrodes in solns. contg. ascorbic acid were also investigated. The charge transfers in poly-pyrrole film might include contributions from both palorons and bipolarons.

73. -,-, REACTIONS-OXIDATION CATALYSIS

Dong, Shaojun; Cha, Guangli. Electrocatalytic oxidation of ascorbic acid at a prussian Blue film modified micro-disk electrode. J. Electro. anal. chem. Interfacial Electro. chem. 1991, 315(1-2), 191-9.

The preparation and the behaviour of a prussian blue (PB) film on a pt. microdisk electrode are described. Electrocatalytic oxidation of ascorbic acid occurred at the PB film modified Microelectrode. This is a typical exaple of a modified microelectrode in electrocatalysis following the previous theor, studies (1991), and the related catalytic reaction rate const. was determined.

74. -,-, TISSUES, ANIMAL

Xu, F.; Shen, G.L.; Yu, R.Q.; Xie, J.Y.; Zhang, M.F. Studies on sensor for L-ascoric acid using animal tissue slices. Yaoxue Xuebao. 1990, 25(5), 368-73.

A bioselective membrane electrode for L-ascorbic (I) was made with tissue slices. It was made from procine liver tissue slice covering an oxygen electrode. The effect of buffer mediator, pH, temp. antiseptics (NaN_3, $CHCl_3$, or phenol). Slice thickness, etc. on the response characteristics of the electrode was examd. In the presence of Cu ions, a linear relation between dynamic response of the electrode and the logarithm of I concn. was obsd. for 21.14 to 352.3 μg/mL, with a correlation coeff. of 0.9996 and the Michael's const. of 0.8 m mol/L. Electrode was used to det. I in pharmaceuticals.

75. -,-, TREATMENTS

Sternitzke, Kent; McCreery, Richard L.; Bruntlett, Craig S.; Kissinger, Peter T. In Situ laser activation of glassy carbon electrochemical detectors for liquid chromatography : demonstration of improved reversibility and detection limits. Anal. Chem. 1989, 61(17), 1989-93.

A conventional liq. chromatog./electrochem. (LCEC) cell was modified to permit irradn. of the glassy carbon (GC) working electrode with intense Nd: YAG laser pulses. Laser pretreatment before LC injection led to large increases in the heterogeneous electron-transfer rate

const., 12°, for several redox. systems, including glutatione (GSH), ascorbic acid (AA), and dihydroxyphenglacetic acid (DOPAC).

For ascorbic acid, however, the response decreased much more slowly with time because the activated response corresponded to the mass transport limit.

76. -, GENERATIONS - QUANTITATIVE

Pastor, T.J.; Vaigand, V.J.; Ciric, I. Quantitative anodic generation of Cerium (IV) in acetic acid. Anal. Chim. Acta. 1982, 138, 87-92.

Conditions for the electrochem. generation of Ce(IV) in HOAC with high current efficiency are described. Coulometric titrns. for detg hydroquinone, 2-methyl hydroquinone, 2-chlorohydroquinone, and ascorbic acid biamperometric or potentiometric end points are reported, benzidine is viable for visual and end points. Current efficiency depends on the compn. and concn. of the supporting electrolyte and the amt. of H_2O and acetic anhydride in the anolyte. The formal redox potential of the Ce(IV)/Ce(III) system decreases as concn. of KOAC in the soln. increases.

77. -, ION'S EXCHANGE

EI-Shahawy, Anwar S. Electronic spectroscopic studies of L-ascorbic acid and adenine. Proc. Pak. Acad. Sci. 1991, 28(1), 1-15.

SCF-CI calcns. were carried out for the singlet and triplet electronic transitions of adenine and L-ascorbic

acid. The charge densities and bond orders were calcd. from the self-iterative eigenvectors of the SCF-eigen functions for the mols, cations, and anions. L-Ascorbic acid is predicted to be mainly in the anionic form in polar soln. Electron transfer from adenine to L-ascorbic acid is absent.

78. -, ORGANIC-REACTIONS-REDOX

Ogumi, Zempachi; Mizoe, Tashiyuki; Takehara, Zenichiro. Application of the SPE method to organic electrochemistry. IX. Reaction profiles of an iron redox couple incorporated into platinum-Na fion with ascorbic acid. Bull. Chem. Soc. Jpn. 1988, 61(12), 4183-7.

Fe^{3+} was incorporated into Pt-Na fion. The behaviour of Fe^{3+} as a media for was examd. in a system comprising the oxidn. of L-ascorbic acid (AA) to dehydroascorbic acid (AD). The diffusion of AA in Nafion is slower then that of Fe^{3+}. The concn profiles of Fe^{3+} and AA in Pt.-Nafion were clarified and a reaction of a media for with AA took place within a very narrow zone close to the surface. The averaged diffusion coeffs. of Fe^{3+} and AA are 1.5×10^{-7} and 4.7×10^{-8} $cm^2/8$ resp.

79. -, OXIDATION-PULSE-DIAGNOSIS

Sanchez-Maestre, M.; Ruiz, J.J. Application of differential pulse polarography to the study of some aspects of the oxidation of L and D isomers of ascorbic acid. An.Quim. 1991, 87(7), 842-8.

The electrochem. oxidn. of the L and D isomers of ascorbic acid in aq. solns. was studied over a wide pH range on the basis of differential pulse polarog. The influence of the pH, reactant concn., temp., boric acid content, drop time and sign. and pulse amplitude on the different polarog. parameters was studied for the oxidn. processes involved on the basis of these data and diagnostic criteria for this technique, reaction mechanisms for the different processes are proposed.

80. -, SYSTEMS-REDUCTION

Oda, Kuniyuki; Ohnuma, Takeshi, Ban, Yoshio. A facile removal of the arenesul fomyle group by electrochemical reduction of sulfonamides in a new cooperative system of anthracene and ascorbic acid. The control of criss crossamulation. J. Org. Chem. 1984, 49(6), 953-9.

Electrochem. removal of the N-tosyl group (Ts) from phenylenediamine deriv. I, which easily derived from 2,5-$H_2O(O_2N)C_6H_3Me$ in 5 steps in ~94% overall yield, was effected successfully by a new cooperative system of anthracene and ascorbic acid, affording the benzazocine II via. controlled crisscross annulation.

81. ELECTROPLATING METHODS-CARBON CONTENT

Izaki, Masanobu; Enomoto, Hidehiko; Omi, Takashi. Hardness and carbon content of an iron electroplate from a sulfate both containing L-ascorbic acid and citric acid. Hyomen Gijutsu. 1989, 40(11), 1304-5.

Electroplating is described of an Fe-C alloy on cold rolled steel sheets (JIS SPCC) by 3 methods, i.e. a conventional bath, Gogish's bath, and the author's sulfate bath contg. a small amt. of L-ascorbic acid, and Citric acid. A good electroplate was produced from the author's bath. A bright steel sheet with surface hardness of ~800 H and contg. ~1% C could be obtained at ~70% current efficiency.

82. EMBRYOLOGY-REACTIONS DERIVATION

Fodor, G.; Sussangkarn, K.; Arnold, R.; Mathelier, H.; Mohacsi, T.; Mujumdar, R.; Butterick, J.; Veltri, R.W. From methylglyoxal to new immuno potentiating ascorbic acid derivatives. Acta Biochim. Biophys. Hung. 1987, 22(2-3), 165-79.

A review with 38 refs. on the development of immunostimulant ascorbic acid derives., such as 2-(5-methyl furyl)-3-ketogulonolactone cyclohemiketal, which play an important role in cell regulations.

83. ENDOTOXIN-INHIBITION EFFECT OF

Aleo, Joseph J.; Padh, Harish. Inhibition of ascorbic acid up take by endotoxin : evidence for mediation by Serum factor (S). Proc. Soc. Exp. Biol. Med. 1985, 179(1), 128-31.

The effect of Escherichia coli endotoxin on the ascorbic acid (I) [50-81-7] uptake by 3T6 fibroblasts was studied. Endotoxin inhibited uptake by fibroblasts in

a dose-dependent manner. The inhibition of endotoxin takes place only in the presence of unheated serum decomplementing serum by the heat in activation at 50° for 30 min eliminates endotoxins inhibitory effect on I uptake. The effect of endotoxin appears to be instantaneous since the inhibition seen in the cells without any preexposure was similar to the cells pre exposed to enddox in for upto 6 h. Polymyxin B sulfate which is known to bind the liquid A portion of endotoxin did not reverse the inhibition of I up take caused by endotoxin.

84. ENZYMES, MICROORGANISM PRODUCTION OF

Maruyama, Akikiko; Koizumi, Satoshi; Fujio, Tatsuro. Enzymic production of ascorbic acid-2-phosphate. Agric. Biol. Chem. 1990, 54(9), 2309-13.

Microorganisms that produce ascorbic acid-2-phosphate (ASA2P) from ascorbic acid (ASA) and ATP were screened from culture collection of 715 strains, three microorganisms, pseudomonas azo to colligans KY4661, P. paucimobilis KY4084, and an unidentified bacterium KY3132 were selected as AsA2P-producers. When using 50 mg (wet. wt.) of P.azotocolligans cells per mL as the enzyme source 3.7 m MAsA2P were produced for 23 h, from 30 mM AsA at the C-2 position specifically.

84. FRUITS-SEEDS-GROWTH

Sandhu, S.S.; Dhillon, B.S. Relation between growth pattern endogenous growth hormones and metapolites in the developing

fruit of Sharbati peach. Indian J. Agric. Sci. 1982, 52(5), 302-10.

In peach (Prunus persica) the pericarp grew rapidly during 1-7 and 11-18 wk. after flowering, with an intervening 4 wk. period of slow growth. The seed remained a richer source of cytokinins during 1-7 and 7-11 wk. where flesh wasarich source during 11-18 wk. The seed had more auxins than flash during 1-7 wk. The seed and flesh contained an equal amt. of auxins during 7-11 wk., but the flesh had more auxins during 11-18 wk. Gibberellins and abscisic acid indicated antagonism to each other. Total acidity was at its peak during 11-18 wk. The sucrose constituted the main sugar in the whole fruit, whereas glucose dominated in the flesh. The Ascorbic acid decreased as the fruit ripened.

86. GLUCOSE-D-GLYCOSIDATION-CONDENSATION OF

Gakhokidze, R.A.; Bedukadze, L.I.; Labartkava, M.O. Condensation of derivatives of D-glucose with 5-O-acetyl-6-bromo-6-deoxy-L-ascorbic acid. Soobshch. Akad. Nauk Gruz. SSR. 1988, 130(3), 561-3.

Glycosidation of 5-O-acetyl-6-bromo-6-deoxy-L-ascorbic acid by D-glucose derivs. ICR = AC, $PhCH_2$) in Et_2O contg. Ag_2CO_3 gave 64.6% benzyl derivs. II, III (R = $PhCH_2$) and 30.2% acetyl derivs. II, III (R = Ac).

87. GRAFTING GUARGUM MEASUREMENTS

Bajpai, U.D.N.; Jain, Alka; Rai, Sandeep. Grafting of polyacrylamide on to guargum using potassium persulfate/ascorbic acid redox system. J. Appl. Polym. Sci. 1990, 39 (11-12), 2187-204.

The grafting of polyacrylamide on to guargum in aq. medium initiated by the $K_2S_2O_8$/ascrobic acid redox system was studied gravimetrically at 35 $\pm$ 0.20 in the presence of atm. O and Ag^+ ions. The rate of grafting increased with temp., concn. of redox components, acrylamide, and gulargum. But at higher Concn. of guargum, the rate of grafting decreased. A mechanism for grafting and suitable rate expression were suggested.

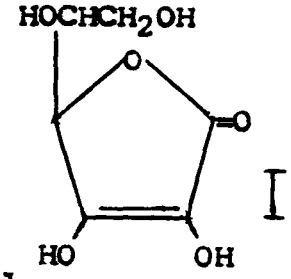
88. HUMAN-NUTRITION-VITAMINS-ITALY

Prrini, Marisa; Simonetti, P.; Ciappellano, S., Testolin G. Vitamin A,E and C nutriture of elderly people in North Italy, Int. J. Vitam. Nutr. Res. 1987, 57(4), 349-55.

The vitamin A,E and C nutritional status of 313 noninstitutionalized elderly people in a small town and in an agricultural village at North Italay was evaluated. The population is at low risk for vitamin A deficiency and 10-20% of the people over 70 living in the small town have low level of vitamin E, but the nutritional status of ascorbic acid, where the levels are in adequate in >50% of the population, is disturbing.

89. -, PHYSIOLOGY-CELLS-PROLIFERATION

Jakobsen, Karin; Eik-Nes, Kristen B. Hexavalent chromium and ascorbic acid interaction on proliferation of the human cell line NHIK3025. Toxicol. Lett. 1982, 13(1-2), 113-18.



I

When cells from the human cell line NHIK3025 were cultured for 4 days, with Cr(VI) at $8x10^{-7}$ M, the relative cell no. was reduced to 38%. This effect of Cr(VI) was abolished if ascorbic acid (I) [50-81-7] and chromate were added simultaneously to the incubation medium, but not if I was added 24 h prior to chromate addn. Dehydroascorbic acid [490-83-5] was not able to reduce the effect of $K_2Cr_2O_7$ either when added simultaneously or 24 h prior to chromate exposure. Therefore, the cells could only be protected from the toxic effect of Cr(VI) when I was added at the same time as $K_2Cr_2O_7$.

90. -,-, EXPERIMENTS

Shashindram, C.H.; Adithan, C.; Gandhi, I.S., Ghosh, M.N. Assessment of ascorbic acid status as revealed by lingual test. Indian J. Physiol. Pharmacol. 1982, 26(1), 91-3.

Among 303 humans of age 5-42 yr. lingual ascorbic acid [50-71-7] test meantimes were 41.65 (for dichlorophenolindophenol decolorization), and 15.2% of the subjects had times >120S, a level indicating possible deficiency. Among 246 of the above subjects having mean test times of

26.3 S, There was the difference in test times with respect to age or sex, and the lingual ascorbic acid level was correlated with plasma ascorbic acid.

91. -,-, GROWTH-INVESTIGATIONS

Leung, Ping,; Dunham, Wolcott B.; Tsao, Constance S. Ascorbic acid with cupric ions as chemotherapy for human lung tumor xenografts implanted beneath the renal capsule of immunocompetent mice. In vivo. 1992, 6(1), 33-40.

The growth of human lung carcinoma xenografts implanated beneath the renal capsule of immunocompetent mice was investigated (the six-day subrenal capsule assay) by using combinations of ascorbic acid and cupric ions. A max. suppression of growth of this human lung tumor, LX-1, was obsd. at an estd. consumption level by the mice of 6 to 8 g ascorbic acid and 2 to 5 mg cupric ions per day per kg body wt. The data suggest that more than one oxidative or degradative product of ascorbic acid or of some copper compds. may be responsible for the obsd. antitumoractivities, and that chemotherapeutic effect is being produced at same stoichiometric ratios of ascorbic acid to cupric ions. When a combination of the two substances was consumed by the mice, optional therapeutic effect was exerted on the implanted xenografts.

92. -,-, HUMUS-ADSORPTION

Yung, Susanna; Mayersohn, Michael; Robinson, J. Barry. Ascorbic acid adsorption in humans : a comparison among

several dosage forms. J. Pharm. Sci. 1982, 71(3), 282-5.

Ascorbic acid (I) [50-81-7] absorption in 4 subjects was investigated from several other dosage forms contg. 1 g of the vitamin soln, tablet, chewable tablet, and timed released capsule). Approx. 85% of an i.v. dose was recovered in the urine as I and its major metabolites; In contrast, only ~30% of the dose was recovered from the soln. and tablet forms. A considerably smaller fraction of the dose (~14%) was recovered from the timed-release capsule. There was considerable inter subject variation in vitamin consideration should be given to the effect of the extent of I adsorption on the results of clin. trials.

93. ION'S EXCHANGE REACTIONS

Zhang, Fa.; Fang, Huai; Chen, Wei; Liu, Zhongli; Liu, Youcheng. ESR study on quinone radical anions formed by the reaction of ascorbic acid with quinones. Gaodeng Xue Xiao Huaxue Xuebao. 1990, 11(5), 540-2.

Quinone radical anions of P-benzoquinone,2,5-dimethyl-, 2,6-dimethyl-, tert-butyl-, and 2,6-di-tert-butyl-P-benzoquinones,1,4-naphthoquinone and 2-methyl-naphthoquinone were detected by ESR in a water-DMSO mixed solvent with pH = 8.5 when the corresponding quinones reacted with ascorbic acid. The results were rationalized by a single electron transfer reaction between the quinone and ascorbic acid.

96. -, PLASMA ANALYSIS

Margolis, Sam A.; Paule, Robert C.; Ziegler, Regina G. Ascorbic acid dehydroascorbic acid measured in plasma preserved with dithiothreitol or metaphosphoric acid. Clin.Chem. (Winston-Salem, N.C.) 1990, 36(10), 1750-5.

A rapid method is described for accurately and precisely measuring ascorbic acid and dehydroascorbic acid in plasma. Total and time is < 10 min, replicate analyses of a single pool provide precisions ≤ 2%, and values measured in supplemented samples a gree with known concns. of 4.68 and 11.83 mg/L. The stability and homogeneity of lyophilized plasma samples supplemented with ascorbic acid and dithiothreitol are documented. A procedure in which metaphosphoric acid (50 g/L) is used to prep. a ref. material for the measurement of ascorbic acid and dehydroascorbic acid is also described. The procedure for both acids consists of first measuring the native ascorbic acid, the producing the dehydroascorbic acid at neutral pH, with dithiothreitol, and finally measuring the total ascorbic acid, dehydroascorbic acid is then detd. by difference.

97. -, SOLUTIONS, AQUEOUS-DETERMINATION OF

Charykov, A.K.; Tikhonova, N.B.; Telepova, N.D. Refractometric determination of diacetonesorbose after extraction from technological solutions of ascorbic acid. Zh. Anal. Khim. 1988, 43(11), 2086-9.

A combined method for quant. detn. of diacetonesorbose

(DAS) in technol. solns. is based on measuring the refractive index of aq. solns. of DAS, followed by extn. of DAS with two portions of chloroform and one portion of di-Et ether and repeated measuring the residual refraction of the aq. solns. The systematic errors for detg. 20-40 wt.% DAS were negligible.

98. -,-,-, HEAT STABILITY

Chonan, Takao; Nishizawa, Makoto. Heat stability of L-ascorbic acid in aqueous solutions. Hokkaidoritsu Eisei kenkyushoho. 1987, (37), 73-3

Ascorbic acid in a soln. of normal oxygen concns. (~8 mg/L) was decompd. during boiling more than that in the soln. of low oxygen concn. (~1 mg/L). Cu^{2+} and Fe^{2+} accelerated the decompn. of ascorbic acid, esp. at higher oxygen concns.

99. -.-. MELONIC GLUTARIC

Apelblat, Alexander. Enthalpies of solution of malonic glutaric, ascorbic, and DL-aspartic acids in water and of fumaric acid in 0.1 mol. dm^{-3} HCl. J. Chem. Thermodyn. 1990, 22(3), 253-6.

Enthalpies of soln. of five org. acids in water-measured by using a Parr calorimeter.

100. -,-, MULTICOMPONENT, SOLVENT

Blokhara, R.L.; Satish Kumar. Solute-Solvent interaction studies of some solutions involving Ascorbic Acid. J. Indian Chem. Soc. July 1986, 63(7), 702-4.

Multicomponent solutions plays an inmportant role in physiological processes of body fluids and cell equilibria. Ascorbic acid is believed either to promote the secretion of enzymes or create suitable molecular environment for enzymes to act effectively. Kaulgod et al. have studied the apparent molar volume, apparent molar compressibility and viscosity of ascorbic acid in water and 0.06 M NaCl at 25°.

101. -,-, VOLUMETRIC

Wang, J.; DeWald, H.D. Rapid stopped flow volummetry with potential scanning. Anal. Chim. Acta. 1982, 136, 77-84.

The stopped flow voltammetric technique is based on measurements of the differences between currents with the soln. flow on and off while the applied potential is scanned linearly. A flow cell with an inpinging jet of soln. on a stationary planar or porous C disk electrode is employed. A non steady-state modulation approach is utilized at a compromise between sensitivity and speed. Charging and surface transient back ground currents are eliminated, allowing measurements at micromolar concns. well defined current potential curves are obtained and compared with those obtained by differential pulse voltammetry. Ascorbic acid, $Fe(CN)_6^{4-}$, NADH, and dopamine were used as test systems. When 3-6 on and 3-5 off flow periods were used detection limits of 0.1 uM dopamine and 0.2 uM ascorbic acid or $Fe(CN)_6^{4-}$ were obtained.

102. METHODS, ALUMINON-ELIMINATION - USE OF

Cabrera, F.; Madrid, L.; DeArambarri, P. Use of ascorbic and thioglycolic acids to eliminate interference from iron in the aluminon method for determining aluminium. Analyst (London). 1981, 106 (1269), 1296-301.

The use of ascorbic acid thioglycolic acids as inhibitors for the interference of Fe in the aluminon method of P.H. USU (1963) was examd. the use of ascorbic acid as proposed by T.C.Z. Jayman and S. Sivasubramaniam. (1974), changed Fe interference from Pos. to neg. causing AL to be understd. However, the addn. of 0.2 mL of a 1 vol.% of the thioglycolic acid to solns-contg. Al in amts. ranging 10-50 ug suppressed the interference from $\leq$ 900 µg of Fe.

103. -, BERTHELOT-PHENOL-INTERFERENCE

Ngo, T.T.; Phan, A.P.H.; Yam, C.F.; Lenhoff, H.M. Interference indetermination of amonia with the hypochlorite-alkaline Phenol method of Berthelot. Anal. Chem. 1982, 54(1), 46-9.

The blue color resulting from the formation of indophenol in the Berthelot method of detg. NH_3 was suppressed by primary and secondary amines, sulfides, thiols, and ascorbic acid, and to a lesser extent by tertiary amines. It is postulated that nucleophic addns. of amines, thiols and other nucleophiles to quinoid intermediates of the Berthelot reaction decrease the formation

of indophenol. It is also possible that reducing agents deplete hypochlorite to suboptimal leaves.

104. -, CARBOXYLATE ANIONS ADSORPTION - ROLE OF

Dos Santos Afonso, Maria; Morando, Pedro J.; Blesa, Miguel A.; Banwart, Steven; Stumm, Werner. The reductive dissolution of iron oxides by ascorbate : The role of carboxylate anions in accelerating reductive dissolution. J. Colloid Interface Sci. 1990, 138(1), 74-82.

For the massive reductive dissoln. of Fe_3O_4 by ascorbic acid, the exptl. rate law $R = k [HA^-]^{1/2} H^+$ suggests the involvement of surface. $Fe^{III}A^-$ complexes. Adsorption isotherms of ascorbic acid on to FeO_3 at pH 3 and 25° yield a Langmuir type surface complexation const. $K_s = (9.57 \times 10^8 M^{-1})$, Autoacceleration of the reductive dissoln. by dissolved Fe^{II}-carboxylate complexes is obsd. in EDTA ascorbic acid mixts. the rate reaches a maxat. intermediate EDTA values where synergistic effects between EDTA and Fe^{II}-EDTA complexes are important.

105. -, CYNOFERATE COMPLEXES-DETERMINATION OF

Burger, Nicoletta. Determination of iron and cyanide in cyanoferrate complexes. Talanta. 1985, 32(1), 49-50.

A simple method of destroying cyano-complexes and of analyzing for both Fe and CN in a single sample of a cyanoferrate complex is proposed. The method is based on the decompn. of cyanoferrate complexes in acidic medium

in the presence of ascorbic acid, 1,10-phenanthroline, and Hg^{2+}. The ascorbic acid acts as a reducing agent and Hg^{2+} is a catalyst for ferroin formation.

106. -, KINETIC DEGLYCATION

D'Andrea, Gabriele; Maccarrone, Mauro; Oratore, Arduino; Avigliano, Luciana; Messerschmidt, Albrecht. Kinetic features of ascorbic acid oxidase after partial deglycation. Biochem. J. 1989, 264(2), 601-4.

By means of specific exoglycosidases sugars have been removed under non denaturing conditions from ascorbic acid under non naturing conditions from ascorbic acid oxidase (AAO), different deglycation schedules being followed. Deglycation clearly affects the kinetic features of AAO, leading to an increase of affinity and catalytic ability of the enzymac forms so generated. A better exposure of the catalytic site residues might occur upon treatment with exoglycosidases. This is supported by the 3-dimensional X-ray structure of Zucchini (cucurbita pepo medullosa; Courgette) AAO.

107. -,-, FRUITS PREPARATION

DeVillena Rueda, F.J. Manuel; Asensio Martin, A.; PoloDiez, L.M.; Perez, R. Kinetic determination of ascorbic acid in fruit juices and pharmaceutical preparation. Microchem. J. 1989, 39(1), 112-18.

A kinetic method was proposed for the detn. of ascorbic acid based on its reaction with the $Mn(CN)_5NO^{2-}$

complex in alk. medium and absorbance measurements at 384 nm. The reaction was first order with respect to OH^-, $Mn(CN)_5NO^{2-}$ and ascorbic acid, the rate const. being 8.17×10^4 $L^2 mol^{-2} s^{-1}$ at 25°. The main interference was from CN^-. Good results were obtained by applying the method to organge and lemon juice some pharmaceutical prepns.

108. -, LEFEBVRES ALKALINE

Maslowska, Joama; Owezarek, Alina. Potentiometric studies on mixed complexes of alkaline-earth-group metals with ascorbic and tartaric acids. Pol. J. Chem. 1988, 62(1-3), 75-83.

The lefebvre method of potentiometric surfaces was used to study the formation of mixed complexes of Be(II), Mg(II), Sr(II) and Ba(II) with ascorbic (H_2ASC) and tartaric (H_2 Tart) acids in aq. solns. at a const ionic strength 1.0 ($NaClO_4$) and at 298 K. In these systems, mixed complexes were formed with the compn. $[M(HASC)(H\ Tart)]^0$. Thus stability consts. were detd.

109. -,-, POTENTIOMETRIC

Maslowska, Joanna; Owczarek, Alina. Potentiometric studies of mixed complexes on manganese (II) with ascorbic and tartaric acids. Zesz. Nauk-politech. Lodz, Technol. Chem. 1987, (40), 19-30.

Complex formation of Mn(II) with ascorbic (H_2ASC) and tartaric (H_2 Tart) acids in aq. solns. of $HClO_4$ was investigated by the method of Lefebvres potentiometric

surfaces. In addn. of binary complexes, only 1 mixed complex of the formula $[Mn(HASC)(Tart)]^-$ was formed; its stability const. is log $\beta_{111} = 2.055 \pm 0.181$.

110. -, PHOTOCOLORIMETRIC DETERMINATION OF

Sarkisyan, V.V.; Mnatsa Kanyan, Sh. Tsi.; Markosyan, D.E. Photocolorimetric method for determination of silica in the presence of vanadium ions. Plast. Massy. 1990, (5), 73-4.

Si was detd. in the presence of excess vanadate (e.g. in solns. with VO_3-SiO_2 = 300:1 ratio) by spectrophotometry of reduced silicomolybdic acid at 590 nm. Ascorbic acid was used as the reducing agent instead of Mohr's salt. The interference of PO_4^{3-} and VO_3^- was suppressed by tartaric acid. The relative errors were with in ± 20% for detg. 25-150 mg SiO_2/dm^3.

111. -, PHTHALOCYANINE ELECTRODES - DEVELOPMENT OF

Wring, Stephen A.; Hart, John P., Dracey, Louis, Birch, Brain J. Development of screen-printed carbon electrodes, chemically modified with cobalt phthalocyanine, for electrochemical sensor applications. Anal. Chem. Acta. 1990, 231(2), 203-12.

A method is described for the prodn. of screen-printed graphite electrodes and also for similar electrodes chem. modified with the electrocatalyst cobalt phthalocyanine. Using cyclic votammetry, the electrochem. behaviour of these electrodes towards ascorbic acid, reduced gluta-

thione and CoA (COA-SH) was investigated. The modified electrodes were found to give significant decreases in the over-potential required for the oxidn. of these species at carbon electrodes. The limits of detection for ascorbic acid and reduced glutathione at the modified films were $5x10^{-8}$ and $1x10^{-7}$ M, resp. The calibration graphs were also linear upto 2 mM concns. of both analytes.

112. -, REDUCTANTS-SEPARATION - USE OF

Poczynajlo, A.; Janiszewski, Z.; Al-Shukrawi. H. The use of ascorbic acid for reductive separation of plutonium from Uranium. Nukleonika. 1988, 33(8-9), 203-18.

Ascorbic acid was applied in 1-stage exts. for the reductive stripping of Pu in Purex systems. sepn. of U and Pu in a lab. mixer. Setter at a mole ratio of reductant to Pu(IV) 1:1 was performed.

113. -, SEPARATION - COACERVATION-ROLE OF

Samejima, Masayoshi; Hirata, Goichi; Koida, Yoshiyuki. Studies on microcapsules. I. Role and effect of coascervation including agents in the micro encapsulation of ascorbic acid by a phase separation method. Chem. Pharm. Bull. 1982, 30(8), 2894-9.

The rde and effect of coacervation inducing agents such as bulyl rubber, polyethylene [9002-88-4] and polyisobutylene [9003-27-4] in micro-encapsulation were investigated by using phase sepn. from cyclohexane soln.

with change of temp. Ascorbic acid [50-81-7] was used as a core material and Et cellulose was used as a wall-forming material. Among the 3 different coacervation including agents, poly isobutylene was suitable for micro encapsules and a slow dissoln. rate polyisobutylene changed the gel into a coacervate and resulted in the formation of smooth and thick-walled microcapsules and also largely prevented the aggregation of microcapsules.

114. -, SPECTROPHOTOMETRIC-REDUCTION-DETERMINATION OF

Datta, Arabinda; Pal, Aditya Kumar; Ghosh, Jagabandhu; Amalraj; M. Spectrophotometric determination of tungsten by reduction with ascorbic acid. J. Inst. Chem. (India). 1982, 54 (6), 269-70.

A spectrophotometric method for detg. W is base on its redn. with ascorbic acid in NaOH soln. at pH 9-10 to form a blue complex. The abosrbance was measured at 650 nm. Beer's Law was obeyed for 2-30 ppm W. The sensitivity and molar absorptivity were 0.003 $\mu g/cm^2$ and 3.522×10^3 L $mol^{-1}cm^{-1}$. The effect of deverse ions was studied.

115. -, X-RAY-ANALYSIS

Nomura, Hiroaki; NaKamachi, Hideo; Wada, Yoshikazu. X-ray analysis of L-ascorbic acid 2-O-phosphate. Chem. Pharm. Bull. 1982, 30 (3), 1024-9.

The dipiperazinium salt of the title compd. is monoclinic, space group P21, with a 14.469(4), b 8.546(2),

C9.306(2)A, and B102.50 (2)°; Z = z for dc = 1.42. The structure was solved by both direct and heavy atom methods and refined by least squares to a final R = 0.048. At coordinates bond length and angles, and NMR data are given. The location of the PO_4 group was confirmed. The NMR data of the Mg and K salts were compared with that of the title compd. to show the acid of all 3 has the same mol. structure.

116. ORANGE, POSTEURIZED-ANALYSIS-EFFECT OF

Sattar, Abdus; Durrani, M.J.; Khan, R.N.; Hussain, B.H. Effect of packaging materials and fluorescent light on HTST-pasteurized orange drink. Z. Lebensm.-Unters. Forsch. 1989, 188(5), 403-3.

High temp./short time (HTST) pasteurized orange drink packed in clear, green and amberglass bottles and coextruded wax laminated paper (Tetra Park), was exposed to fluorescent light of 50-60 ft. candles for 32 days at ambient temp. chem. anal. revealed significant effects of packages and light on different quality parameters during storage. Ascorbic acid losses amounted to 60.6, 54.6, 51.0, and 45.5% resp., in clear green glass, Tetra Pak, and amber glass Vs. 42.4% in an unexposed control.

117. OXDIATION-ALKALINE-EXPERIMENTS.

Mordente, A.; Miggiano, G.; Martorana, G.E.; Meucci, E.; Santini, S.A.; Castelli, A. Inactivation of alkaline phosphatase by autoxidation of L-ascorbic acid. Acta Med. Rom. 1987, 25(2), 168-78.

Ascorbic acid irreversibly inactivates alk. phosphatase; O and metal ions are both essential for the enzyme oxidative modifications. Dehydroascorbic acid and H_2O , products of vitamin C autoxidn. do not affect enzyme activity, Expts. with ascorbate-2-sulfate, mercaptoethanol, and urate suggest that enzyme inactivation is due to active O speeie (s) produced during ascorbate autoxidation. Among these, hydroxyl radicals, generated via the ascorbate-modified Haber-Weiss cycle may be responsible for the protein damage. Expts. with hydroxyl radical scavengers, enzyme substrates and products indicate that a site specific radical attack takes place at or near the active centre.

118. -, ANODIC-GENERATION, COULOMETRIC

Mihajlovic, R.; Vajgand, V.; Jaksic, L.; Manetovic, M. Coulometric generation of hydrogen ions by anodic oxidation of esters of gallic acid, phenols and ascorbic acid in propylene carbonate. Anal. Chim. Acta. 1990, 229(2), 287-90.

The application of esters of gallic acid (Me, Et, Pr, Bu, Octyl and dodecylgallate), phenols (Pyrocatechol and pyrogallol) and ascorbic acid for the coulometric generation of H^+ ions in propylene carbonate, is described. The current potential curves recorded for these depolarizers, titrated bases, indicator and the solvent used showed that the investigated depolarizers are oxidized at lower potentials than the oxidn. potentials of other

components in the soln. H^+ ions formed by the oxidn. of these depolarizers were used for the titrn. of org. base (pyridine, piperidine and quinoline) with visual and potentiometric end-point detection. The current efficiency = was 100%.

119. -, BENZENEDIOLS-MECHANISM

McAuley, A.; Spencer, Lee; West, P.R. Kinetics and mechanism of the oxidation of benzenediols and ascorbic acid by bis (1,4,7-tri azacyclononane) nickel (III) in aqueous perchlorate media. Can. J. Chem. 1985, 63(6), 1198-203.

The title reactions with the title Ni complex outer sphere electron transfer reagent are examd. the inverse H^+ conc. dependence is due to reactions of the conjugate bases (both the acid and the conjugate base react). The kinetics are consistent with a rate detg. 1-electron transfer reaction (for the acid and its conjugate base) followed by rapid oxidn. of the formed radicals ions or radical intermediates. A Marcus LFER treatment of the data allows the estn. of electron self exchange rates for org. redox couples. The importance of bond-reorganization in electron transfer is discussed.

120. -, CATALYZE-MODIFICATIONS

Gomathi, H.; Rao, G. Prabhakara. Chemical and electrochemical modification of the glassy carbon surface with quinhydrone. J. Electroanal. chem. Interfacial Electrochem. 1985, 190(1-2), 85-94.

The suggested involvement of quinone/hydroquinone like groups on treated C surfaces was substantiated by running cyclic voltammetric expts. on different glassy C substrates in H_2SO_4 medium contg. the simple quinhydrone. The results also indicate that quinhydrone is strongly adsorbed on to the C surface both chem. and electrochem. and gives rise to stable modification of the surface. The quinhydrone modified C surface was found to catalyze oxidation of ascorbic acid in glycin buffer and voltammograms in support of this are given.

121. -, ELECTRODES-VOLTAMETRIC

Kumbhat, Sunita.; Kapoor, R.C. Voltammetric behaviour of ascorbic acid at the DME. J. Indian Chem. Soc. 1987, 64(1), 20-3.

A differential pulse (DP) polarog. study of the anodic oxidn. of ascorbic acid was made over a pH range 3-11 in Britton-Robinson buffer medium. The nature of the limiting current was evaluated observing the influence of Hg pressure on the wave light of the d.c. polarograms. The no. of electrons involved in the electrode process was confirmed by varying the pulse amplitude and noticing the $W_{1/2}$ in DP polarograms. In acidic medium, the electrode reaction involves reversible (peak half width) oxidn. of ascorbic acid to dehydroascorbic acid. Two peaks appear in the DP polarograms in the alk. medium due to establishment of an equal between the acid anion and its hydrated

form. Both the forms get oxidized at different potentials.

122. -, KINETIC ACIDIC

Martinez, Pablo, Zuluaga, J.; Radriguez, A.F. Oxidation mechanism of L-ascorbic acid by hexacyanoferrate (III) in strongly acidic media. Z. Phys. Chem. 1990, 271(3), 597-601.

A kinetic study of the title reaction suggested a mechanism involving the neutral mol.for the region of PHO to -1 and the protonated species for the region pHO to 1.

123. -,-,-, CATALYSIS

Rosolowski, Szczesny. Use of molybdate reduction with ascorbic acid for the kinetic determination of micromounts of ascorbic (V). Chem. Anal. 1981, 26(2), 287-96.

The redn. of molybdate with ascorbic acid proceeds in 3 stages ; formation of molyb-doarsenic heteropoly acid; an induction stage; and formation of molybdenum blue. The reaction is catalyzed by As(V) and can be used for the catalytic detn. of determinable concn. of 0.2 and 0.02 µg As/mL is used with the tangent method and method of steady time resp.

124. -,-,-,-

Taqui Khan, M.M.; Shukla, R.S. Ruthenium (III) EDTA catalyzed oxidation of ascorbic acid by hydrogen peroxide in aqueous solution. J. Mol. Catal. 1987, 39(2), 139-45.

The kinetics of oxidn. of ascorbic acid to dehydro-ascorbic acid by H_2O_2 catalyzed by ethylenediaminetetra acetatoruthenate (III) were studied over the pH range 150-2.50, at 30° and μ = 0.1 M KNO_3. The reaction has a first order dependence on ascorbic acid and Ru(III)-EDTA concn. an inverse first order dependence on hydrogen ion concn., and is independent of H_2O_2 concn. on the pH range studied. A mechanism is proposed in which ascorbate anion forms a kinetic intermediate with the catalyst in a pre-equi-step. Ruthenium (III) is reduced to ruthenium (III) in a rate determinating step and is reoxidized with H_2O_2 back to the Ru (III) complex in a fast step.

125. -,-,-, DETERMINATION OF

Celardin, F.; Castillo, F.J.; Greppin, H. Simple kinetic determination of trace amounts of ascorbic acid in plant extracts. J. Biochem. Biophys. 1982, 6(2), 89-93.

A kinetic method of ascorbic acid assay based on the lag produced during the evolution of horse radish peroxi-dase-catalyzed oxidn. of guaia col or of homovanillic acid by H_2O_2 is described and applied to ascorbic acid detn. in Sedum album exts.

126. -,-,-, MECHANISM OF

Martinez, Pablo.; Rodriguez, A.F.; Zuluaga, J. Kinetics and mechanism of oxidation of L-ascorbic acid by chloropenta-mmine cobaltate (III) in acidic media. Bull. Pol. Acad. Sci. Chem. 1989, 36 (7-8), 311-17.

The kinetics and mechanism of oxidn. of L-ascorbic acid by chloropentamminecobaltate (III) ions were studied by a spectroscopic method as a function of pH, ascorbic acid concn., ionic strength and temp. in acidic aq. solns. The pH dependence of the process is ascribed, in the acidity range investigated (pH = 0.8-2), to the direct oxidn. of the ascorbic acid mol., for which $K = 7.3 \times 10^{-5}$ $M^{-1}s^{-1}$ at 25°. The results are discussed in ref. to the data for this reaction in weakly acidic and basic media and for the oxidn. by other oxidants.

127. -,-,-, REDUCTION

Saiprakash, P.K.; Rajanna, K. Chinna,; Rao, G. Venkateshwer. Reduction of thallium triacetate and manganese triacetate by L-ascorbic acid - a kinetic study. Cienc. Cult. 1983, 53(12), 1935-42.

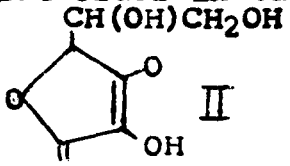
The kinetics of red. of $Tl(OAC)_3$ and $Mn(OAC)_3$ by L-ascorbic acid (H_2A) was studied under the conditions $[H_2A] \ll [oxidant]$. The order in $[H_2A]$ is 1in both system. The order with respect to $[Tl(OAC)_3]$ is fractional and $[Mn(OAC)_3]$ is 1. The reaction rate in both the systems was unaffected by salt concn. and $[H^+]$. However, the addn. of NaOAC system retarded the rate of redn. of $Tl(OAC)_3$ considerably. The rate of red. of $Tl(OAC)_3$ decreased with a corresponding increase in the HOAC concn. and that of $Mn(OAC)_3$ remained unaltered. Addn. of $Mn(OAC)_2$ did not affect in the rate. Free radical were detected in both

the systems. Probable mechanism are suggested. The individual kinetic parameter, were evaluated and compared with a variety of 1 and 2 electron oxidants.

128. -,-,-, STUDY OF

Rajanna, K. Chinna; Devi, Y. Uma, Saiprakash, P.K.
A kinetic study of reduction of mercuric acetate by L-ascorbic acid in aqueous acetic acid. Cienc. Cult. 1982, 34(5), 675-80.

The redn. kinetics of $Hg(OAc)_2$ by the title compd. (I) to give dehydroascorbic acid, is ist order in each of $Hg(OAc)_2$ and I in HOAc.



II

The rate was unaffected by salts or mineral acids; the rate was decreased with increase in the HOAc concn. The reaction involves the rate limiting decompn. of a I. $Hg(OAc)_2$ complex (formed in a rapid study state prequil) to give II, HgOAc, and HOAc.

129. -,-,-, TREATMENTS

Rajanna, K. Chinna; Rao, G. Venkateshwer; Saiprakash, P.K.
Kinetic and mechanistic aspects of reduction of lead tetraacetate and acetic acid. Z. Phys. Chem. 1982, 263(5), 1025-33.

The kinetics of redn. of $Pb(OAc)_4$ (LTA) and pH iodosoacetate (PIA) by L-ascorbic acid (AH_2) in aq. HPAc was studied to elucidate and compare the similarities in the mechanism. The study revealed a ist order dependence in

[AH_2] and fractional order dependence in [oxidant] . Based on the solvent, salt and [H^+] effects, the nature of the reactive species in both LTA-AH_2 and PLA-AH_2 systems is dipole-dipole type. The reaction sequence obeys the rate law V = kk oxidant AH_2 /(1+K [oxidant] . The kinetic parameters k and K were evaluated at different temps. and the corresponding thermodyn. parameters were derived.

130. -,-, CATALYSIS

Lu, Chunsu; Yang, Kinetics of ascorbic acid oxidation catalyzed by Copper (II) tyrosine complex. Zhaopeng. Wuli-ttuaxue Xuebao. 1987, 3(6), 638-41.

The kinetics of L-ascorbic acid in phosphate buffer (pH = 7.44) at room temp. The rate of Cu(II)-Tyr_2 catalyzed reaction conformed to the Michalies-Menten equation with respect to ascorbate. H_2O_2 and O_2^- were produced during this reaction. The rates were decreased by addn. of catalase or superoxide dismutase resp. A mechanism was proposed.

131. -,-, MARCUSTHEORY-APPLICATION OF

Rao, P.V. Subba; Saradamba, G.V.; Ramakrishna, K.; Rao, K. Mohana; Subbaiah, K.V. Kinetics of oxidation of L-ascorbic acid by iron (III) in presence of 2,2'-pipyridyl-application of Marcustheory. Indian J. Chem., Sect. A, 1989, 28A(12), 1060-3.

Kinetics of oxidn. of ascorbic acid by iron (III) in the presence of 2,2'-bipyridyl has been investigated under anaerobic conditions. The reaction is first order each in

iron (III) and ascorbic acid . The kinetic results provide evidence for the formation of an intermediate complex $Fe(bipy)_2^{3+}$ which reacts with the unionized form of ascorbic acid in the rate limiting stage. The stability const. of the complex has been evaluated from the kinetic data. The kinetic data are compatible with the Marcus theory for outer sphere electron-transfer.

132. -,-, MEASUREMENTS

Hodali, H.A.; El-Zaru, R.A. Kinetics and mechanism of the oxidation of ascorbic acid by hexacyanoferrate (III) and octacyanotungstate (V). Part I. Dirasat-Univ. Jordan. 1989, 16(2), 7-19.

The oxidn. of ascorbic acid by hexacyanoferrate (III) and octacyanotungstate (V) has been studied. The reactions, were conducted in a buffered acid aq. methanolic medium and at const. ionic strength (0.060 M). The reaction has been found to be first order with respect to the oxidant concn. and first order in ascorbic acid concn. The dependence on acidity, suggested a rate law of the form $-1/2\ d[ox]/dt = K[ox][AH_2][H^+]^{-1}$.

The rate measurements for both $K_3Fe(CN)_6$ and $Cs_3W(CN)_8$ were used to calc. the entropies and enthalpies of activation. The differences in the redn. rates of the two complexes have been discussed and a mechanism involving an intermediate formation of ascorbate anion radical has been proposed.

133. -,-, MECHANISM OF

Verma, Mahadevi; Chandak, Anubha; Nand, K.C. Kinetics and mechanism of the oxidation of ascorbic acid by N-bromo-succinimide in acidic media. Acta Cienc. Indica, Chem. 1989, 15(2), 125-32.

The kinetics of oxid. of ascorbic acid with N-bromo-succinimide has been detd. The reaction follows a second order law, unity in each reactant. The reaction has a pos- dependence on H and shows a primary salt effect. It is also characterized by a low energy of activation and neg. mediocre entropy of activation. A plausible mechanism, consistent with the kinetic results has been proposed.

134. -,-,-,-

Xu, Jinhuang, Kinetics and mechanism of the oxidation of ascorbic acid by copper (II). Huaxue Xuebao. 1989, 47(4), 313-18.

The title reaction of ascorbic acid (H_2A) was studied at $[Cu^{2+}] \gg H_2A$ and $[H^+] \gg [H_2A]$. The effect of chloride anion on the kinetics and mechanism has been examd. at $[H^+] = 1.00 \times 10^{-3}$ mol dm^{-3} and the chloride concn. upto 7.00×10^{-3} mol. dm^{-3}. The Arrhenius activation energy is 68.1 KJ mol^{-1}. The stop flow spectrum shows that no Cu HA^+ complex is formed in the system of Cu(II)-ascorbic acid, but the complex ClCuHA is formed in the presence of Cl^-.

135. -,-, METHODS, AQUEOUS - COMPARATIVE STUDY

El-Zaru, R.A.; Hodali, H.A. Kinetics of oxidation of ascorbic acid by octacyanomolybdate (V)in aqueous method : a comparative study. Polyhedron. 1990, 9(1), 113-18.

The oxidn. of ascorbic acid (AH_2) by $Mo(CN)_8^{3-}$ in a buffered acidic aq. methanolic medium was studied and compared with that of $Fe(CN)_6^{3-}$ and $W(CN)_8^{3-}$. The reaction was Ist order with respect to both oxidant and ascorbic acid concns. The dependence on acidity suggested a rate law of the form : $d[ox]/2\,dt. = (k_a + k_b/[H^+])[ox][AH_2]$, where ka is the rate const. of the reaction with the mol. ascorbic acid and$\approx$0 for $Fe(CN)_6^{3-}$ and $W(CN)_8^{4-}$ and k_b is the rate const. of the reaction with the ascorbate anion. The rate measurements for the 3 oxidants were used to calc. the entropies and enthalpies of activation. The differences in the rates of oxidn. of ascorbic acid by the 3 oxidants, which are in the order $Mo^V \gg Fe^{III} > W^V$, are discussed.

136. -,-,-, EFFECT OF

Breier, A.; Stankovicova, T.; Durisova, V.; Ziegelhoeffer, A. Fast method for estimation of the effect of compounds modulating the radical oxidation of sulfhydryl groups on 4-mercapto-2-nitrobenzoic acid applied as a model substance. Chem. Pap. 1989, 43(4), 553-9.

Kinetics of radical oxidn. of 4-mercapto-2-nitrobenzoic acid was investigated in the presence of hydrogen peroxide and iron (II) sulfate, i.e. a hydroxyl radicals

generating system. Initial velocity was used as a criterion for evaluation of efficacy of EDTA and ascorbic acid as model compds. showing down the course of radical oxidns. Acting probably via chelation of the iron (II) ion, EDTA in lower concns. Stimulated but in higher concns. inhibited the course of radical oxidn. of 4-mercapto-2 nitrobenzoic acid. Ascorbic acid, representing a typical scavenger substance, was found to inhibit the above radical oxidn. reaction in the whole range of concns. tested.

137. -,-, REACTIONS - EFFECT OF

Xu, Jinhuang; Jordan, R.B. Kinetics and mechanism of the reaction of aqueous copper (II) with ascorbic acid. Inorg. Chem. 1990, 29(16), 2933-6.

The oxidn. of ascorbic acid by aq. Cu(II) was studied under anaerobic conditions with $[Cu^{2+}]$ in the range $(1-5)\times10^{-3}$ M, total ascorbic acid concn. of 5×10^{-5} M, and H^+ of $(0.50-10)\times10^{-3}$ M in 1.0 M $NaClO_4/HClO_4$ at 25°. The kinetic effect of the Cl^- ion concn. in the range of $(0.5-7)\times10^{-3}$ M was also investigated. The obsd. pseudo-first = order rate const. is given by k obsd. = $(a+b[Cl^-])\ [Cu^{2+}]/(Ka + [H^+])$ with a = $(4.0 \pm 0.13)\times10^{-4}$ s^{-1} and b = 0.58 ± 0.036 $M^{-1}s^{-1}$. The results are discussed interms of the probable mechanisms for the direct and Cl-catalysed paths for the oxidn., and earlier results in the presence of acetate are reanalyzed.

138. -,-,- MECHANISM OF

Xu, Jinhuang; Jordan, R.B. Kinetics and mechanism of the reaction of aqueous copper (II) with ascorbic acid. Inorg. Chem. 1990, 29(16), 2933-6.

The oxidn. of ascorbic acid by aq. Cu(II) was studied under anaerobic conditions with $[Cu^{2+}]$ in the range $(1-5)x10^{-3}$ M, total ascorbic acid concn. of $5x10^{-5}$ M, and H^+ of $(0.50-10)x10^{-3}$ M in 1.0 M $NaClO_4/HClO_4$ at 25°. The kinetic effect of the Cl^- ion concn. in the range of $(0.5-7)x10^{-3}$ M was also investigated. The obsd. pseudo-first order rate const. is given by $K_{obsd} = (a+b[Cl^-])[Cu^{2+}]/(Ka + [H^+])$ with $a = (4.0\pm 0.13)x10^{-4}$ S^{-1} and $b = 0.58\pm0.036$ $M^{-1}S^{-1}$. This results are discussed interms of the probable mechanisms for the direct and Cl^- catalyzed paths for the oxidn. and earlier results in the presence of acetate are reanalyzed.

139. -,-, SOLUTIONS, AQUEOUS MECHANISM

Martinez, P.; Zuluaga, J.; Kraft, J.; Van Eldik, R. Kinetics and mechanism of the oxidation of L-ascorbic acid by tris (oxalato) Cobaltate (III) in basic aqueous solution. Inorg. Chim. Acta. 1988, 146(1), 9-12.

The kinetics and mechanism of the oxidn. of L-ascorbic acid by tris oxalatocobaltate (III) were studied as a function of pH, ascorbate concn., ionic strength and temp. in a weekly basic aq. soln. The pH dependence of the process can be ascribed to the oxidn. of the doubly deprotonated

ascorbate ion. The results are discussed in ref. to literature date for this reaction in weakly acidic medium and for the oxidn. by a series of other oxidants.

140. -, METHODS OSCILLATORY

Young, Jack; Franzus, Boris; Huang, Thomas T.S. Oscillatory behaviour during the oxygen oxidation of ascorbic acid. Int. J. Chem. Kinet. 1982, 14(7), 749-59.

The oscillatory phenomenon was obsd. in aq. soln. during the oxidn. of ascorbic acid (I) with O. Even though the exact no. and amplitude of the oscillations could not be exactly dpulicated for each and every run, such factors as temp., concn. of I and Cu^{2+} ions, and pH affecting the oscillatory behaviour were studied, and those regions where oscillations occured were delineated. A mechanism consistent with the oscillatory behaviour is discussed.

141. -, RATES FORMATION

Fleming, James, E.; Miyashita, Koichi; Quay, Steven C.; Bensch, Klaus G. Bicyclic ring formation is not necessary for the aut-oxidation of ascorbic acid. Biochem. Biophys. Res. Commun. 1983, 115(2), 513-5.

Oxidation rates for ascorbic acid and its derive. do not support the contention that bicyclic ring formation is required for the oxidn. of ascorbic acid.

142. -, REACTIONS CATALYSIS -INVESTIGATION

Imer, Filiz; Koseoglu, Ayten; Sefer, Tamer. Polarographic investigation of ascorbic acid oxidation. Fen.Bilimleri

Derg. 1989, 6, 119-29.

The oxidn. of ascorbic acid by mol. oxygen at 25° and at pH = 4.45 has been studied by the polarog. method. Various catalytic effect of $CuSO_4$, $SnCl_2$, $Al_2(SO_4)_3$, and Na_2SO_3 salts on the oxidn. of ascorbic acid have also been investigated. When there is ascorbic acid alone in the soln., 65% of ascorbic acid decomposes. With in 240 min, where as in the presence of Sn^{2+} or Al^{3+} ions or Na_2SO_3 salt no decompn. of ascorbic acid occurs during the same time. It was obsd. that the cupric ions accelerated the oxidn. process of ascorbic acid, thus the catalytic effect on Cu^{2+} increased linearly with its concns. In the presence of cupric chelate compd. (ethylene diaminetetracetatocuprate II) as a catalyst, the oxidn. of ascorbic acid was quite slow, being 47% with in 19 days.

143. -,-, IRON - ROLE OF

Yamamoto, Keiji, Takahashi, Mareyuki; Niki, Etsuo. Role of iron and ascorbic acid in the oxidation of methyl linoleatemicelles. Chem. Lett. 1987, (6), 1149-52.

Oxidns. of Melinoleate micelles in aq. dispersions induced by Fe and ascorbic acid were studied to elucidate the mechanism of initiation reactions. Initial radicals were generated by the decompn. of linoleate hydroperoxides by Fe and ascorbic acid flunctioned as a reducing agent for Fe^{3+} to give the more reactive Fe^{2+}.

144. -,-, MONOBROMOACETIC ANALYSIS

Puri, J.K.; Vats, V.K.; Sharma, Vijay. Oxidation-reduction reactions and analysis for thioureas, hydrazines, and ascorbic acid in fused monobroacetic acid. Indian J. Chem. Sect. A. 1986, 25A(6), 565-70.

Redox titrns of P(III), Sb(III), As(III), Fe(II), Sn(II), thioureas, hydrazines, and ascorbic acid were carried out, both potentiometrically and visually, in fused monobromoacetic acid as a solvent with $KBrO_3$, KIO_3, $K_2Cr_2O_7$, $KMnO_4$, $K_3Fe(CN)_6$ and ICl as oxidants. The redox reactions of thiourea and hydrazine their substituted derivs. and of ascorbic acid were successfully utilized for the estn. of these compds. at 60 $\pm$ 0.50. Fused monobromoacetic acid is being introduced as a very good nonaq. solvent for such redox. titrns.

145. -,-, REDOX-CHARACTERISTICS

Liu, Youcheng; Liu, Zhengli; Han, Zhengxu. Radical intermediates and antioxidant activity of ascorbic acid. Rev. Chem. Intermed. 1988, 10(3), 269-89.

A review with 104 refs. the following topics are covered : (1) redox. characteristics of ascorbic acid (2) redn. of nitroxides by ascorbic acid, and (3) antioxidant synergism of vitamin C and vitamin E.

146. -,-, SOLVENT - EFFECT OF

Eberhardt, Manfred, K.; Colina, Ramon; Soto, Karen. The reaction of copper (I) oxygen and copper (I-I) ascorbic

acid-oxygen with dimethyl sulfoxide. The effect of solvent. J. Org. Chem. 1988, 54(5), 1084-7.

The reaction of Cu^{+}-O and Cu^{2+}-ascorbic acid-O with DMSO was investigated. The products of these reactions are CH_4 and C_2H_6 in high yields. The ratio of ethane to methane varies from 8 to 0.01, depending on the concn. of Cu^{+}, O, ascorbic acid, oxalic acid, mineral acids and solvent, with a polar aprotic solvent like pure DMSO a high C_2H_6/CH_4 ratio is obsd.; with a polar protic solvent like water a low C_2H_6/CH_4 ratio is obsd. This solvent effect is consistent with the intermediate formation or in the presence of mineral acids to give mainly CH_4 and mainly C_2H_6 in aprotic solvents.

147. -, REDUCTION-ELECTRODES - MECHANISM OF

Ruiz, Juan, J.; Rodriguez-Mellado, Jose M.; Dominguez, Manuel; Aldaz, Antonio. New aspects of the oxidation-reduction mechanism of the ascorbic dehydroascorbic acid system on the dropping mercury electrode. J. Chem. Soc., Faraday Trans. 1989, 85(7), 1567-74.

Recent studies of the oxidn. of enediol compds. and the redn. of di-and tri-carbonyl compds. on a Hg electrode made it advisable to review the oxidn.-redn. mechanism of the ascorbic-dehydroascorbic and system on the dropping Hg electrod. Capacitance vs. potential curves were obtained, showing that under the author exptl. conditions, ascorbic acid is not adsorbed on the Hg surface.

148. -, STOICHIOMETRY CATALYSIS

Sawyer, Donald T.; Chiericato, Glaico, Jr.; Tsuchiva, Tohru. Oxidation of ascorbic acid and dehydroascorbic acid by super oxide ion in aprotic media. J. Am. Chem.Soc. 1982, 104(23), 6273-8.

O_2^- in DMF oxidizes ascorbic acid (I) to dehydroascorbic acid (as the hydrated monomer, II) in a reaction that is first order each in O_2^- and I in the rate limiting step; the reaction has a 3:21-O_2^-. Stoichiometry. The primary step is the concerted transfer of H^+ and H, from the C(3) and C(2) OH groups, to the attracting O_2^- . to give H_2O_2 and dehydroascorbate radical anion which, in a subsequent H^+ induced disproportion by a base catalyzed oxidn. of the anion by H_2O_2, gives II. II is oxidized by O_2^- . in a rapid second order reaction, with a 2:1 O_2^- -II stoichiometry, to give $HOCH_2CH(OH)CH(OH)-CO_2$ and $HO_2CCO_2^-$ and O_2.

149. -, SYSTEMS - TREATMENT

Ragab-Depre, Nadine J. Water disinfection with the hydrogen peroxide-ascorbic acid-copper (II) system. Appl. Environ. Microbiol. 1982, 44(3), 555-60.

Treatment of secondary effluents with H_2O_2 10-ascorbic acid (I) [50-81-7] 10-Cu^{2+} 0.5 mg/L for 60 min. resulted ~99% redn. of the initial plate count. H_2O_2 could be replaced by other peroxygen compds. I could be replaced by other reducing agents, Na_2SO_3 and EtOH [64-17-5] where the most effective Cu^{2+}, however could not be replaced by other metal ions without loss of bactericidal effeciency

of the ternary combination. At a higher pH value the bactericidal effects tended to decrease. The H_2O_2-I-Cu^{2+} combination made it possible to obtain 99% redn. with in 30 min. Cu^{2+} combined to an intermediate product of the ascorbic acid autoxidn. is the toxic agent, and its penetration into the cell is promoted by H_2O_2.

150. PERICYCLE CELL LINE - TREATMENT SYNTHESIS

Arrigoni, O.; Bitonti, M.B.; Cozza, R.; Innocenti, A.M. Liso, R.; Veltri, R. Ascorbic acid effect on pericycle cell line in Allium cepa root. Caryologia. 1989, 42(3-4), 213-6.

The pericycle cells in A. cepa root tips undergo differentiation at the 2C level. The following 2 clear effects of ascorbic acid treatment on the pericycle cell line were obsd., (1) the extension of the upper limit of mitosis from the tip and (2) increase of the labelling index. Ascorbic acid treatment also stimulated the G_1 nuclei of the quiescent centre to undergo DNA synthesis. Apparently, ascorbic acid could have a regulatory role of cell proliferation during the G_1 phase.

151. PHOTOCHEMISTRY CHROMOPHORE ADSORPTION

Schmidt, John A.; Heitner, Cyril. Light induced yellowing of mechanical and ultra high yield pulps. Part 1. Effect of methylation, sodium borohydride reduction and ascorbic acid on chromophore formation. J. Wood chem. Technol. 1991, 11(4), 397-418.

Adsorption difference spectra of bleached thermo mech. pulps (TMP) irradiated with near UV light exhibited 2 apparent adsorption max. at = 410 nm and 330 nm. Expts. with borohydride reduced pulp suggested that photo chem. formation of arom. carbonyls contributed to the λ = 330 nm peak. Chromophare formation followed an apparently Ist order rate law and the rate was unaffected by methylation of phenolic OH groups, or by exhaustive redn. of carbonyl groups with the kinetics of chromophore formation did decrease the maximum change in adsorption coeff. $\Delta K\alpha$. Treatment of bleached TMP with ascorbic acid slowed light induced yellowing substentially, significant yellowing occured only after 2 h. light-induced bleaching of a chromophore with λ max $\approx$ 350 nm, possibly a stilbene occured during the first 90 nm of irradiation.

152. -, REACTIONS, THERMAL-VITAMINS

Weir, Douglas; Hutchinson, Douglas A.; Russell, Judy; Wan, Jeffrey K.S. An electron spin resonance study of organomercury radical complexes with ortho-quinones and vitamin C. Can. J. Chem. 1982, 60(6), 703-9.

Photochem. and thermal reactions of ortho-quinones and organomercury led to the formations of a series of quinone-Hg R-radical complexes. Hyperfine splittings due to 199 Hg isotope were resolved for the 3,5-di-tert-butylbenzoquinone complexes. Photochem. reactions of vitamin C in EtOH with a no. of mercuric salts produced a paramagnetic intermediate which was assigned to the ion-pair involving

the ascorbate radical anion and the mercuric ion. In di-n-Bu mercury, photolysis of vitamin C led to the formation of a radical complex similar to those of quinone-HgR, but with a much smaller hyperfine coupling const. for 199 Hg. A simple thermodel using some Mo calcns on the system of these organometal-quinone radical complexes which include the metal atom, was developed to account for the systematic exptl. observations.

153. PHOTOMETRY-CHROMIUM-DETERMINATION OF

Devi, P. Rama; Hariprasad, C.N.; Seshaiah, K.; Rao, P.V.V. Prasada; Naidu, G.R.K. Photometric determination of chromium (VI). Curr. Sci. 1986, 55(14), 655.

Cr(VI) was detd. by photometric titrn. with L-ascorbic acid soln. in 0.02 N H_2SO_4 medium. The titrn. was monitored at 475 nm. The min. detn. limit was 1.00 mg with an av. error of $\pm$ 1.4%.

154. -, MIXTURES-ANALYSIS- DETERMINATION OF

Verma, Krishna K. Determination of ascorbic acid with O-iodosebenzoate. Analysis of mixtures of ascorbic acid with methionine and cysteine or glutathione. Talanta. 1982, 29(1), 41-5.

Ascorbic acid was detd. in pure solns.pharmaceutical prepns. foods, and biol. fluids by titrn. with O-iodosobenzoate, with visual or photometric detn. of the end point, with leuco-26-dichlorophenolindophenol plus KI

as indicator. Cysteine and glutathione, which interferequant., are masked by cyanoethylation, the cyanoethylated product and methionine were detd. with O-iodosophenzoate in the presence of acidified KBr, with methyl red as indicator. Procedures are given for the anal. of mixts. of ascorbic acid with 5-contg. amino acids.

155. PHOTOPOLYMERIZATION-SOLUTION, AQUEOUS - EFFECT OF

Lenka, Subasini; Nayak, Padma L.; Mohanty, Indu B. Dye sensitized photopolymerization : II-photopolymerization of methyl methacrylate initiated by a crystal violet-ascorbic acid system in aqueous solution. Polym. Photochem. 1986, 7(1), 49-54.

The dye-sensitized photopolymn. of methyl methacrylate [80-62-6] by a crystal violet [548-62-9] ascorbic acid 50-81-7 system in aq. soln. was investigated. The systems were buffered with phosphate buffer, and the effects of monomer, dye, temp., buffer and ascorbic acid on the reaction system were studied. The rate of polymn. was measured gravimetrically and a suitable kinetic scheme was proposed.

156. PHOTOSYNTHESIS-BACTERIA-SOLAR PRODUCTION

Olson, John M.; Bernstein, Jerome D. Solar production of hydrogen. A biological approach. Ind. Eng. Chem. Prod. Res. Dev. 1982, 21(4), 640-6.

A solar Generator was assembled from unit membrane vesicles from green photosynthetic bacteria. The vesicles,

which contain hight-harvesting bacteriochlorophyll a, photochem. reaction centres, and various electron carries, deliver electrons from ascorbic acid [50-81-7] to exogenous electron carriers (Ist ferredoxin and then hydrogenase) where upon H is formed with an over all quantum efficiency of 10% per electron transfered. Another type of photosynthetic membrane from a thermophilic blue-green alga contains both photosystem I and photosystem II reaction centres. This membrane using photosystem II reaction centres alone, is being used to generate O from H_2O and to deliver electrons to a weak reductant, dimethylbenzoquinone. The vesicles from green bacteria coupled to the membranes from blue-green algae should be able to generate H with H_2O as the ultimate electron donor. The max. energy conversion efficiency of such a system is estd. to be ~10%.

157. -, OXIDATION-SYSTEMS

Taqui Khan, Mirza M.; Bhardwaj, Ramesh C.; Bhardwaj, Chhaya. Tris(2-2'-bipyridine) ruthenium (2^+) photosensitized oxidation of ascorbic acid and hydrogen evolution on titanium dioxide. Inorg. Chim. Acta. 1987, 130(2), 153-4.

The mechanism and utility of the aq. title system for energy conversion is discussed. The use of ascorbic acid as a sacrificial reductant leads to higher rates of H_2 formation than are obsd. when Et_3N or EDTA are used as reductants.

158. -, REACTIONS, REDOX

Gowda, H. Sanker; Mohan, B.M. N-substituted phenothiazines as redox indicators in titrations with Cerium (VI) sulfate. Indian J. Chem. Sect A. 1981, 20A(9), 903-5.

Cyamepromazine maleate, profenamine hydrochloride, triflupromazine hydrochloride, fluphenazine dihydrochloride, and perphenazine dihydrochloride are proposed as redox indicators in macro- and micro-titrns. of Fe (II), Ti(III), U(IV), Mo(V), hydroquinone metal, and ascorbic acid with Ce(IV) sulfate in H_2SO_4, HCl and HOAc. The indicators give very sharp and reversible color changes at the equivalence point. Their transition potentials are detd. The present indicators have certain advantages over the existing indicators in ceriometry.

159. -, RICE-GROWTH

Reddy, K.P.; Khan, P.A.; Patnaik, S.; Mohanty, G.B.; Kumar, K.B. Ascorbate oxidase activity in rice shoot apexes during panicle initiation. Plant Cell Physiol. 1986, 27(4), 725-8.

Ascorbate oxidase activity described in the shoot apices of Oryza sativa L. cv. BAMII, a photosensitive rice variety. Ascorbic acid content in the shoot apex increased and exogenous application of ascorbic acid resulted in an earliness in panicle initiation. Photoperiodic treatment promoted panicle initiation with an early activity of ascorbate oxidase showed a neg. correlation with the increase in ascorbic acid content.

160. PHYSIOLOGICAL CHEMISTRY - VITAMINS - EFFECT OF

Tajmir-Riahi, H.A.; Boghai, D.M. Coordination chemistry of vitamin C part IV. The effects of the alkali metal ions lithium, Sodium, Potassium, ammonium, rubidium, and Cesium on the solid and solution structure of L-ascorbic acid. J. Inorg. Biochem. 1992, 45(2), 73-84.

The interaction of L-ascorbic acid with the alkali metal ions has been studied in aq. soln. at pH 6-7. The solid salts of Li-ascorbate $2H_2O$, Ha-ascorbate.H_2O; K-ascorbate.H_2O, NH_4-ascorbate, Rb-ascorbate 2 H_2O , and Cs-ascorbate.$2H_2O$ have been isolated and characterizes by ^{13}C NMR and FTIR. The binding arrangement of the C-1: O group of the acid anion would be similar in the Li, Na, and K salts and differ from those of the NH_4, Rb-, and Cs-ascorbates.

161. PLANTS, CENTROSPERMATOPHYTA-SPECIES-DETERMINATION OF

Istratescu-Guti, Lucretia. Ascorbic acid contents in plants of the Centrospermatophyta and Teichiospermatophya. Farmacia (Bucharest). 1989, 37(2), 123-8.

Ascorbic acid contents of 0-1755 mg% (dry wt. basis) were recorded in leaves, fruits, rhizomes, etc. of 29 species of the centrospermatophyta (including chenopodiaceae, Amaranthaceae, Caryophyllaceae) and 45 species of the Teichospermatophyta (including Rhoedales, Cucurbitales, Campanulales, and Compositales). Cowship (Primula officinalis) leaves, horse-radish (Armoracia rusticana) Leaves, and Cardaminebulbifera contained $>$ 1500 mg% ascorbic acid.

162. -, KRINOPHYTA-SPECIES - DETERMINATION OF

Istratescu-Guti, Lucretia. Ascorbic acid contents in plants of the Krinophyta. Farmacia (Bucharest). 1988, 36(3), 173-6.

Ascorbic acid was detd. in leaves, flowers, and other parts of 33 species of the Krinophyta (including Alismatales, Glumiflorales, Spadeflorales, and Scitaminales). Species of the Liliaceae, Amaryllidaceae, and Dioscoreaceae contained moderate levels of ascorbic acid (219-976 mg%, dry wt. basis), with the exception of Hyacinthus orientalis, Yuccagloriosa, and Agare americana which contained 2000 mg% ascorbic acid. Iris and Galdiolus (Iridaceae) were particularly rich sources of ascorbic acid ($\leq$ 7385 mg%). Alismanatans, Juncus bufonius (May collection), and Colchicum autumnale had very low ascorbic acid contents ($<$100 mg%).

163. -, PARASITIC-SEEDLINGS-SYNTHESIS

Tommasi, Franca.; DeGara, Laura.; Liso, Rosalia; Arrigoni, Oreste. The ascorbic acid system in Cuscuta reflex Roxb. J. Plant Physiol. 1990, 135(6), 766-8.

Seedlings of the parasitic plant C. reflexa synthesize ascorbic acid (AA), but conversion of galactono -Lactone (GL) to AA is low in cuscuta compared to other angiosperms. The AA content of the seedlings and the AA/ dehydroascorbic acid (DHA) ratio are much lower than in any other higher plant. Cuscuta has no AA oxidase, but it

does have AA peroxidase with activity similar to that found in normal green plants. The reducing enzymes ascorbic acid free radical (AFR) reductase and DHA reductase are present. DHA reductase activity is fairly high, but AFR reductase is ten times lower than in etiolated and green plants. These results suggest that AFR reductase ia a key enzyme for maintaining the AA system in the reduced state and explain why the AA/DHA ratio is low in this parasitic plant.

164. -, TISSUES-FACTORS, PHYSIOCHEMICAL-INFLUENCE OF

Elmore, H. Wayne; Samples, Barbara; Sharma, Sanjeev; Harrison, Marcia. Influence of cultural and physiochemical factors on ascorbate stability in plant tissue culture media. Plant Cell. Tissue Organ Cult. 1990, 20(2), 131-5.

Ascorbic acid rapidly decays in plant tissue culture media. Within 50 min. to 3 h after prepg. 100 mM solns., ascorbic acid was destroyed. Autoclaving shaking flasks, high light intensity, and increasing pH over a range from 4.5-7 accelerated decya. Ascorbic acid was oxidised to dehydroascorbic acid which also underwent decay. Within 11 h and 15 min after adding ascorbic acid both ascorbic acid and its oxidn.products, dehydroascorbic acid, disappeared from medium. Since ascorbic acid is rapidly destroyed in plant tissue culture media it may not exert its effect as an intact mol. Instead, its antioxidant/ antibrowning role in plant cell, tissue, and organ cultures may be mediated by some product of further oxidn.

165. -,-, REACTIONS-INTERFERENCE OF

Sharma, Shanti S.; Sharma, Shashi, Rai, Vinay K. Interference of ascorbic acid with the starch iodine reaction. Ann. Bot. 1990, 65(3), 281-3.

Starch estn. in various plant tissues is accomplished using a reaction between starch and iodine. The starch iodine reaction is strongly inhibited by ascorbic acid, a normal cellular constituent of higher plants. The presence of 10^{-4} M ascorbic acid in the reaction mixt. caused an almost complete inhibition of the starch-iodine reaction. This inhibition may be alleviated by increasing the amts. of iodine-potassium iodine (IKI) in the reaction mixt., suggesting the possibility that a complex is formed between ascorbic acid and iodine. Evidence for this comes from a shift in absorption max. of ascorbic acid due to the addn. of IKI.

166. -, ZYGOPHYLLACEOUS - RAJASTHAN

Nag, T.N.; Grover, Sharda; Tiwari, Asha; Surendrajit; Shekhawat, S.S.; Harsh, M.L. Free endogenous ascorbic acid from zygophyllaceous plants growing in the arid zone of Rajasthan. Indian J. Bot. 1986, 9(2), 112-14.

Various parts of Fagonia cretica, Peganum harmala, Seetzenia orientalis, Tribulus alatus, Tribulus terrestris and Zygophyllum simplex were analyzed to detect free ascorbic acid content. The amt. of ascorbic acid increased from root to fruit in these plants. In F. cretica the free

ascorbic acid concn. in all samples were higher as compared with these of other plants species. Max. endogeneous ascorbic acid was found in the fruit of F. cretica (150 mg/100 g) and min. in the root of T. terrestris (40 mg/100 g).

167. POLAROGRAPHY-SAMPLING-ANALYSIS

Alexander, P.W.; Marpaung, H. Rapid-flow analysis using differential pulse polarography with automatic sampling. Talanta. 1982, 29(3), 213-17.

Differential pulse polarog. is used in a rapid-flow anal. system for automated detn. of Ph, Zn, and ascorbic acid acetate buffered sample solns, without the need for sample deaeration. By use of a N-segmented buffer stream at high flow rates, high speed sampling $\leq$ 180 samples/can be obtained at a flow rate of 22.8 mL/min through a polarog. flow cell fitted to the dropping Hg electrode. A linear calibration range of $\sim 0.1\times10^{-4}$—1.0×10^{-3} M is found for Pb, Zn, and ascorbic acid with resp. detection limits of 4.0, 0.8, and 0.2×10^{-6} M, limited by the high base line current and high noise level. Vitamin C tablets can be routinely analyzed without prior sepn. steps, provided the sample and wash solns. are matched in electrolyte compn. A precision of better than 1% relative std. deviation is obtained at a sampling rate of 120 h.

168. POLYMER COATING-ELECTRODES TREATMENT MAMILIAN CEREBRAL USE OF

Baur, John E. An anion-selective polymer coating for carbon fiber micro electrodes. J. Electrochem. Soc. 1990,

137(4), 209-212.

An anion selective electrode coating, i.e. poly (4-vinylpyridine)/vinyl ferrocene copolymer (QPVP/VF), was synthesized and characterized. It was used in the prepn. of modified electrodes for measuring electroactive anions of neutrochem. interest, 3,4-dihydroxyphenylacetic acid (DOPAC) and ascorbic acid (AA), in the presence of such electroactive cations as dopamine and norepinephrine. These electrodes ultimately will be used to minotiro anion concn. changes in the mammalian brain. QPVP/VP shows promise as an anion-selective coating for carbon fiber electrodes used as in vivo probes. The concn. of anion exchange sites is sufficiently large for preferential incorporation of anions. This incorporation is fast (subsecond) and reversible for singly charged anions such as AA and DOPAC. The films can be easily deposited on to the electrode surface, and the coverage can be controlled by the deposition time.

169. POLYMERIZATION, AQUEOUS THERMAL SYSTEMS, REDOX

Manivannan, Gurusamy, Maruthamuthu, Pichai. Aqueous thermal polymerization of acrylonitrile initiated by the peroxomonosulfate ascorbic acid redox system. J. Chem. Phys. Phys.-Chim. Biol. 1989, 86(5), 1155-67.

Aq. polymn. of acrylonitrile initiated by the peroxomonosulfate ascorbic acid redox system was at 25-35° under deaerated conditions. The overall rate of polymn.

(R_p), followed gravimetrically, showed a second order dependence on [monomer], a first order dependence on [peroxomonosulfate] and a first order dependence on [ascorbic acid] at low concns. of ascorbic acid ($>2.25 \times 10^{-2}$ mol. dm^{-3}). The activation energy was estd. to be 37.2 KJ mol^{-1}. R_p increased with increased in ionic strength, but decreased with increase in added [H^+]. A suitable reaction mechanism was proposed explaining the obsd. rate law.

170. -, REACTIONS-RADIATIONS

Pemberton, D.R., Johnson, A.F. Polymerization of vinyl acetate using visible radiation and a dye-reducing agent sensitizer. I. Preinitiation and initiation reactions involving ethyleosin and ascorbic acid. Polymer. 1984, 25(4), 529-35.

The ethyl eosin [6359-05-3] -ascorbic acid (I) [50-81-7] - photosensitized polymn. of vinyl acetate (II) [108-05-4] in aq. MeOH using visible radiation occured by a mechanism in which polymn. occurs after an induction period during which the dye color fades completely. During this period the dye is excited by incident radiation and reacts with the I to form free radical species. These reacts with dissolved O to produce H_2O_2. It is shown that the polymn. of II is initiated by products of the reaction between I and H_2O_2.

171. -,-,-

Pemberton, D.R.; Johnson, A.F. Polymerization of vinyl acetate using visible radiation and a dye-reducing agent sensitizer. 2 . Kinetic studies and polymerization mechanism. Polymer. 1984, 25(4), 536-42.

The polymn. of vinyl acetate [108-05-4] photosesnitized by ethyl eosin [6359-05-3] and ascorbic acid (I) [50-81-7] in aq. MeOH shows a marked induction period before polymn. commences, but there after, irradn. does not affect the rate of polymn. Both dissolved O and water are essential for polymn. and the rate passes through a mix. as the concn. of dye or I is increased. A mechanism for the reaction is proposed involving initiation of polymn. by OH radicals. Polymn. initiated by reaction between H_2O_2 and I is also studied as this system is thought to participated on the photochem. system.

172. -,-, SYNTHESIS

George, Anne; Radhakrishnan, Ganga; Joseph, K. Thomas. Graft copolymerization of ethyl acrylate on to gelatin using hydrogen peroxide and ascorbic acid in aqueous medium. J. Polym. Sci., Polym. Chem. 1985, 23(11), 2865-74.

Gelatin was modified at 60° by treating with Etacrylate using an initiator comprising H_2O_2 with ascorbic acid [50-81-7] . The effects of synthetic variables in the graft copolymn. reactions were discussed in light of percent grafting, grafting efficiency, and rate of polymn.

173. -, SYSTEMS

Song, Qi; Zheng, Ping. Studies on the graft copolymerization of acrylonitrile on to humic acid. Gaofenzi Xuebao. 1987, (5), 388-92.

$K_2S_2O_8$-$FeSO_4$ and $K_2S_2O_8$-ascorbic acid systems showed good humic acids (HA) in aq. medium at low pH. The degree of grafting od fiferent types of HA was about the same and could reach >75%. A portion of the grafted HA (~20%) degraded under strong alk. conditions. Grafting at the carboxylic group of HA was proposed through ester linkage.

174. -,-, KINETICS

Reddy, G. Gangi; Nagabhushanam, T.; Rao, K. Venkata; Santappa, M. Polymerization of methyl methacrylate in the presence of molecular oxygen. A Kinetic study. Polymer. 1981, 22(12), 1692-8.

CH_2:$CMeCO_2Me$ [80-62-6] was polymd. in aq. medium initiated by a Cu^{2+}-ascorbic acid (I) [50-81-7] -O system at 40° and a kinetic study of the reaction is presented. The rate of polymn. (R_p) showed an increase constancy, and then a decrease with increasing Cu^{2+} concn. The order with respect to Cu^{2+} concn. was 0.5 in the rate increase region. The orders in monomer concn. changed gradually from 1.0 to 2.0 with increasing Cu^{2+} concn. R_p was independent of I concn. and O concn. at high concns. These results indicate that termination by mutual

interaction of chain radicals predominated at low Cu^{2+} concn., whereas termination was exclusively by metal ions at high Cu^{2+} concn. R_p also increased with temp. and ionic strength and the K_p/K_t 1/2 value was calcd. and compared with literature values. Chain lengths were detd. by viscometry for the polymers obtained under various exptl. conditions.

175. -,-,-

Reddy, G.G.; Nagabhushanam, T.; Rao, K.V.; Santappa, M. Oxygen promoted radical polymerization of acrylonitrile in aqueous nitric acid. A kinetic study. Eur. Polym. J. 1981, 17(12), 1253-7.

The polymn. of CH_2:CHCN 107-13-1 initiated by the O-ascorbic acid [50-81-7]- Fe^{3+} system was studied in dil. HNO_3, at -40°. The rate of polymn. R_p, was detd. gravimetrically. A reaction mechanism was proposed and a rate law was presented to explain the results. R_p increased with ionic strength and HNO_3 concn. upto 0.25 M. An initial rate increase with temp., followed by a decrease was obsd. chain lengths of the polyacrylonitrile [25014-41-9] products were detd. viscometrically.

176. -,-,-

Reddy, G. Gangi; Nagabhushanam, T.; Rao, K. Venkata; Santappa, M. Oxygen-ascorbic acid-vanadyl ion initiating system. A kinetic study of the polymerization of methyl

methacrylate and acrylonitrile in aqueous sulfuric acid. J. Macromol. Sci. Chem. 1982, A17(8), 1203-24.

The polymn. of Me methacrylate (I) [80-62-6] and acrylonitrile (II) [107-13-1] initiated by the O-ascorbic acid (III) [50-81-7] -VO^{2+} system was studied at 40° in dil. H_2SO_4. The rate of polymn. R_p, was followed gravimetrically and was proportional to $[I]^{13}$, $[O_2]^{0.6}$ and $[VO^{2+}]^0$ at $[VO^{2+}] = (4-8)\times10^{-4}$ M in the polymn. of I. In the polymn. of II, R_p was dependent on $(II)^{15}$, $[O_2]^{10.5}$, and $[VO^{2+}] > 10^{-3}$ M it was proportional to $[II]^{1.7}$, $[O_2]^{0.7}$, and $[VO]^{-0.6}$. The chain length of the polymers was detd. viscometrically.

177. -,-,-

Dash, P.C.; Das, D.P., Mohanty, B.K.; Samal, R.K.; Nayak, M.C. Pentavalent vanadium-ascorbic acid redox system initiated polymerization of acrylonitrile. J. Macromol. Sci. Chem. 1982, A17(9), 1357-70.

Kinetics of polymn. of acrylonitrile 107-13-1 initiated by NH_4VO_3 [7503-55-6] -ascorbic acid (I) [50-81-7] were investigated in aq. H_2SO_4 at 35-50°, and the rates of polymn. of V^{5+} disappearance, etc. were measured. The polymn. is initiated by an org. free radical arising from the V^{5+}-I complex formation followed by subsequent decompn. and termination by V^{5+} ions. A suitable kinetics scheme was proposed and the various rate parameters were evaluated.

178. -,- REDOX

Uhniat, Maria; Sikorskii, Ryszard T.; Woroszylo, Leokadia. Initiation of the polymerization of acrylic acid and sodium acrylate by the redox system hydrogen peroxide-ascorbic acid. Vysokomol. Soedin. Ser. A, 1981, 23(11), 2420-4.

The redox system H_2O_2-ascorbic acid [50-81-7] was effective for the polymn. of acrylic acid [79-10-7] and Na acrylate [7446-81-3] in 10% aq. soln. at pH 7 and 9.4, resp. The activation energies of polymn. were 75.7 and 6.26 KJ/mol, resp. and the activation energies of initiation were 25.6 and 32.2 KJ/mol., resp. The polymns were followed calorimetrically in an adibatic system. In the absence of monomers the catalyst components react to form oxalic acid, which is not further oxidized.

179. -,-,- INVESTIGATIONS

Bajpai, U.D.N.; Nivedila, Miss. A new redox initiating system for the polymerization of vinyl monomers. J. Macromol. Sci., Pure Appl. Chem. 1992, A29(4-5), 339-55.

A new redox system, dioxane-ascorbic acid, is investigated for the homopolymn. of vinyl monomers. Detailed kinetic studies on the aq. polymn. of acrylamide by this initiating system are done iodometrically at 35 $\pm$ 0.20. The effect of various additives, such as Org. Solvents, inorg. salts or surfactants on the rate of polymn. are studied. The retardation consts for org. solvents are

evaluated by the "intercept method". The overall energy of activation is 8.75 K cal/deg. mol, at temp. 25-45°. A suitable mechanism is suggested. The following rate expression : $R_p \propto [\text{acrylamide}]^{-1.0} [\text{dioxane}]^{1.0} [\text{ascorbic acid}]^{0}$ is obeyed.

180. -,-,-,-

Schirge, H.; Schegel, R. Investigations on polymerization of vinyl chloride in microsuspension. Acta Polym. 1991, 42(9), 423-7.

By use of a redox initiation system contg. dilauroyl peroxide/cetyl peroxide carbonate, $CuSO_4$, and ascorbic acid, the overall polymn. rate of vinyl chloride could be controlled to give const time. conversion behaviour. A const. over all rate of polymerization was attained for narrow concn. ranges of Cu^{2+} per total initiator concn. and ascorbic acid per total initiator conc. The maximum over all polymerization rate was determined by the related total initiator conc. The overall rate of polymerization was calculated for various total initiator compn. and the conversion behaviour depended strongly on the Cu^{2+} concn.

181. -,-,- RATE OF

Lenka, Subasini, Dhal, Akshaya K. Vinyl Polymerization initiated by peroxydiphosphate. VII. Polymerization of acrylonitrile initiated by peroxydiphosphate-ascorbic acid redox system. J. Polym. Sci., Polym. Chem. 1982, 20(8), 2117-22.

The rate of polymn. of acrylonitrile [107-13-1] by $K_4P_2O_8$-ascorbic acid [50-81-7] redox initiator increased with increasing $P_2O_8^{4-}$ concn., the reaction order being 0.5. Polymn. was Ist order in monomer conc. The overall activation energy was 4.6 K Cal/mol. The effect of surfactants on the rate of polymn. was detd. and a kinetic scheme is proposed.

182. POTENTIOMETRY-SYSTEMS-TECHNIQUES

Parveen, S.; Dubey, K.P. Metal ascorbic acid-ethyl enediamine/2,2'-dipyridyl mixed-ligand systems-potentiometric studies. Natl. Acad. Sci. Lett. (India). 1982, 5(9), 303-4.

Mixed ligand complexes of Be(II), Zr(IV), and U(VI) with ascorbic acid and 2,2'-dipyridyl or ethylenediamine were detd. by potentiometric titrn. at 25° and ionic strength 0.1M (KNO_3). Formation cnsts. where evaluated by the modified form of the Irving-Rossotti. titrn. technique.

183. REACTIONS. BRAIN-DIFFERENCES

Deitrich, Richard A.; Bludeau, Pequita; Baker, Rodney, C. Brain ascorbic acid levels : mice and rats selected for differences in acute reactions to ethanol. Alcohol Alcohol. 1988, 23(1), 57-62.

There are variations at ascorbic acid levels in different brain areas of mice and rats. However, there are no differences in ascorbic acid levels between lines of mice selectively bred for differences in EtOH sensitivity

for 25 generation. Thus, it is unlikely that brain ascorbic acid plays a significant role in the acute sedative effects of EtOH in these mice. Studies with inbred strains of mice known to differ in EtOH preference, acute sensitivity and with drawal sensitivity also failed to reval and differences in brain ascorbic acid levels. There were differences in ascorbic acid content between selectivity bred lines of rats in various brain areas at generation 5 of selection.

184. REDUCTANTS-TITRIMETRIC-DETERMINATION OF

Gowda, H. Sanke; Shakunthala, R.; Subrahmanya. U. Potentiometric and titrimetric determinations of some reductants with N-bromosuccinimide. Indian J. Chem., Sect. A 1981, 20A(8), 823-6.

N-bromosuccinimide is proposed as a potentiometric and titrimetric oxidant for direct titrn. of As(III), Sb(III), hydrazinium sulfate, semicarbazide hydrochloride, isonicotinic acid hydrazide, phenylhydrazine, hydrochloride, and ascorbic acid. Quinoline yellow, variamine blue, diphenyl benzidine and Rhodamine-Bare suggested as indicators in macro- and micro-titrns. of the reductants with N-bromosuccinimide because of very sharp color change of the equivalence points. The transitions potentials of the indicators are reported. Arsenic (III) is suggested for standardization of N-bromosuccimide soln.

185. RESPIRATION-FRUITS-TOMATO- EFFECT OF

Mehta, P.M.; Bhavannarayana, K. Effect of growth substances on the respiratory activity in tomato fruits. Comp. Physiol. Ecol. 1981, 6(3), 177-9.

Ascorbic acid [50-81-7] (25 ppm) and sucrose [57-50-1] (10,000 ppm) stimulated respiration by detached tomato (Lycopersicon esculentum) fruits. [999-81-5] (10 ppm inhibited respiration by harvested green fruits, and was slightly stimulated respiration by harvested green fruits and was slightly stimulatory at various further stages of ripeness CCC in combination with ascorbic acid was stimulatory at all stages.

186. SEPARATION-PURIFICATION-SOLVENTS-MECHANISM

Hiral, Takayuki; Komasawa, Isao. Separation and purification of vanadium and molybdenum by solvent extraction followed by reductive stripping. J. Chem. Eng. Jpn. 1990, 23(2), 208-13.

The solvent extn. of V and Mo by TOMAC from neutral solns. was studied. V was extd. preferentially by an anion exchange mechanism. The pentavalent vanadyl anion in an org. soln. was reduced to tetra- or trivalent cations by contact with an aq. soln. contg. a reducing agent such as L-ascorbic acid. This behaviour enables the V to be stripped selectively by chain redn., with Mo remaining in the org. phase. A sepn. effeciency of 1.64×10^4 was

obtained for an aq. soln. contg. initially equal concns. of the 2 metals by single extn. followed by single selective stripping.

187. SOLVENTS-BIAMPEROMETRIC-ELECTRODES - USE OF

Ghosh, D.; Prasad, B.B. Use of platinum-graphite biamperometric indicator in non aqueous mixed solvents : determination of Copper (I), hydroquinone and ascorbic acid using ammonium hexanitratocerate, Indian J. Chem. 1984, 23A(8), 687-8.

Pt-graphic biamperometric indicator electrode system was used in the detn. of Cu(I), hydroquinone, and ascorbic acid in non aqn. mixed solvents (1:1 MeCN-HOAC) by using titnr. curves are sharp yielding precise and reproducible results.

188. -, FORMS, TAUTOMETRIC - EFFECT OF

Hoeweler, U.; Baecker, T.; Klessinger, M.; Eckerl-Maksic, M.; Maksic, Z.B. Theoretical studies of the solvent effect on the stability of the ascorbic acid tautomers. Croat. Chem. Acta. 1991, 64(3), 539-49.

A M1 Calcns. on 3 conformers of each of the 4 tautometric forms of ascorbic acid are reported. Solvent effects on the relative stability of the various structures are assessed by applying a combined quantum. chem. and force field approach. It was very important to fully optimize both the water environment and the solute, which was achieved it cratively by a suitably modified AM1 Hamiltonian

taking into account the charge polarization due to the solvent. CI calcns. indicate that the AM1 method tend to underest bond delocalization effects so that correlation effects are important.

189. SPECTROCHEMISTRY-REACTIONS-OXIDATION

Khan, M.M. Taqui; Shukla, R.S. Kinetic and spectroscopic study of the formation of an intermediate ruthenium (III) ascorbate complex in the oxidation of L-ascorbic acid. Polyhedron. 1991, 10(23-24), 2711-15.

The formation of an intermediate $[RuCl_2(H_2O)_2\ HA]$ 1; H_2A = ascorbic acid by the interaction of L-ascorbic acid and dichlorotetraaquoruthenium (III) is reported at T = 25-40°. The kinetics and mechanism of the formation of 1 were studied as a function of $[Ru^{III}Cl_2(H_2O)^{4+}]$, $[H_2A]$, pH, ionic strength, and temp. The rate of formatinn of 1 was first order in $[Ru^{III}Cl_2(H_2O)^{4+}]$ and $[H_2A]$. The rate has an inverse dependence on $[H^+]$, ionic strength dependence indicated the formation of 1 by monoanionic and cationic species in soln. Decompn. of 1 takes place slowly and gives the products dehydroascorbic acid and $[Ru^{II}Cl_2\ [H_2O]\ 4]$. A detailed discussion of the kinetic data and a comparison of rate and equil. consts. are presented with activation and thermodyn. parameters.

190. SPECTROELECTROCHEMISTRY-ELECTRODES, MICRO-TRANSMISSION

Xie, Yuanwu; Che, Guangchun, Jilin. Spectroelectrochemistry with cylindrical carbon fiber microelectrodes. Electrochem.

Acta. 1991, 36(1), 203-7.

Transmittance spectroelectrochem., can be performed using a group of cylindrical micro electrodes. A dependence of absorbance on electrolytic charge during the potential step was derived. The rate const. of catalytic reaction of the ferrocyanide-ascorbic acid system was detd. using single potential step. Open circuit relaxation chrono-absorptometry. This is the first report that the reaction can still be considered as a pseudo-first order reaction when the concn. of ascorbic acid is close to and even slightly lower than the concn. of errocyanide. The diffusion of ascorbic acid toward electrode surface is contractive and the diffusion of electrogenerated ferricyanide from the electrode surface to the bulk of soln. is expansive.

191. SPECTROMETRY-ADSORPTION-ATOMIC-EFFECT OF

Gilchrist, G.F.R.; Chakrabarti, C.L.; Byrne, J.P. Effect of ascorbic acid on the appearance temperature of Lead in graphite furnace atomic absorption spectrometry. J. Anal. At. Spectrom. 1989, 4(6), 533-8.

A thermodn. (gas sphere) equil. model of atomization was used to explain the shift of the appearance temp. of the Pb at absorption signal to a lower value when ascorbic acid is used as a matrix modifier. Exptl. results of the effect of gas phase compn. on the appearance temp. of the Pb at absorption signal are presented. The partial pressure of H_2 was detd. at various temps. during the ashing and the

atomization cycle. The partial pressure of CO, CO_2, CH_4 were very low for the tube wall heating rate of 1.7 KmS^{-1}, CO was present in appreciable amts. for the tube wall heating rate of 1.5 K ms^{-1}. The results are cnsistent with the hypothesis that H_2 and CO released by the pyrolysis of ascorbic acid decrease the partial pressurem of O_2 in the furnace.

192. -,-,-,-,-

Gilchrist, G.F.R., Chakrabarti, C.L.; Byrne, J.P. Effect of ascorbic acid on the appearance temperature of Lead in graphite furnace atomic absorption spectrometry. J. Anal. At. Spectrom. 1989, 4(6), 533-8.

A thermodn. (gas sphere) equil. model of atmoziation was used to explain the shift of the appearance temp. of the Pb at absorption signal to a lower value when ascorbic acid is used as a matrix modifier. Exptl. results of the effect of gas phase compn. on the appearance temp. of the Pb at absorption signal are presented. The partial pressure of H_2 was detd. at various temps. during the ashing and the atomization cycle. The partial pressure of CO, CO_2, CH_4 were very low for the tube wall heating rate of 1.7 K ms^{-1}; CO was presented in appreciable amts. for the tube wall heating rate of 1.5 K ms^{-1}. The results are consistent with the hypothesis that H_2 and CO released by the pyrolysis of ascorbic acid decrease the partial pressure of O_2 in the furnace and thereby cause of the equil. position of the reaction PbO (g) $\rightleftharpoons$ Pb(g) + 0.5 O_2 to shift to the

right, favoring prodn. of more Pb(g), which results in a lowering of the appearance temp. of the Pb at absorption signal in agreement with the equil. model.

193. -,-, COMPARISON OF

Tominaga, Mamoru; Umezaki, Yoshimi. Comparison of ascorbic acid and related compounds as interference suppressors in electrothermal atomic absorption spectrometry. Anal. Chem. Acta. 1982, 139, 279-85.

Suppression of interferences from Na, Cu, and Fe(III) chlorides by addn. of ascorbic acid and related compds. was investigated for the detn. of Pb, Sn, Mn, V, and Mo. Absorption vs. time curves for these metals with and without ascorbic acid and other compds. showed that the peak appeared earlier for Pb, and later for Sn, Mn, Mo and V when ascorbic acid was present. Suppression of interferences was also achieved, but usually less effectively, by lactones, carboxylic acids, $(NH_4)_2CO_3$, and formal dehyde. CO or CO_2 generated by pyrolysis of the suppressors may participate in the suppression of interferences.

194. -,-, EFFECT OF

Mihara, Yuichi; Yokota, Katsushi. Effect of ascorbic acid on the determination of heavy metals by atomic absorption spectrometry after coprecipitation with zirconium hydroxide. Annu. Rep. Tohokucoll. Pharm. 1990, 37, 247-50.

Simple soln. contg. 30-150 ug of heavy metal (Cr,Fe, Mn,Cu,Zn,Cd, Pd) was treated with L-ascorbic acid (I)

followed by aq. soln. of 15 mg $ZrOCl_2$-$8H_2O$. After the soln. was adjusted pH 9-10, the ppt. was obtained and detd. by at absorption spectrometry, using 1,10, 10^2 and 10^3 mg of I, the recoveries of the heavy metals were 100-110, 92-118, 0-1 and 0% resp.

195. -,-, EFFICIENCY

Tsalev, D.; Slaveikova, V. Comparative study of ruthenium, rhodium and palladium as chemical modifiers in graphic furnace atomic absorption spectrometry. Spectrosc. Lett. 1992, 25(2), 221-38.

Comparative study on the efficiency of ruthenium, rhodium and palladium as chem. modifiers for thermal stabilization of 18 analyte elements with high and mederate volatility was performed. Addn. of ascorbic acid provided higher temps. of thermal pretreatment by +50 to +25° for the analytes : As, Ge, P, Se, Sn and Tl, as well as better performance for Gas In and Tl. Possible mechanisms and trends in stabilization are discussed.

196. -,-, ATOMIC

Goyal, Neelam; Dhobale, A.R.; Patel, B.M.; Sastry, M.D. Atomic absorption spectrometric studies of the atomization of boron from a carbon rod atomizor. Anal. Chim. Acta. 1986, 182, 225-9.

B (≤ 20 μg mL^{-1}) in aq. solns. gives no absorbance but the addn. of ascorbic acid, esp. with Ti greatly enhances the signal, leading to a detection limit of 0.2

μgB/mL. The presence of U (≤ 10 mgmL^{-1}) only slightly decreases the B signal.

197. -,-, ELECTRODES-MEASUREMENT

Rice, Ronald J.; Pontikos, Nicholas, M; McCreery, Richard L. Quantitative correlations of heterogeneous electron-transfer kinetics with surface properties of glassy carbon electrodes. J. Am. Chem. Soc. 1990, 112(12), 4617-22.

Raman spectra, Capacitance (C^o), phenanthrenequinone (PQ) adsorption, and heterogeneous electron-transfer rates for ferri/ferrocyanide, dopamine, and ascorbic acid were monitored after fracturing, polishing, and laser activating glassy C electrodes (GC-30). Alternations in the Raman Spectrum indicate changes in C microstructure, while PQ adsorption and C^o provide measures of microscppic surface area. Polishing caused minor changes in C disorder and microscopic surface area, but the polished surface and poor electron transfer kinetics. Laser activation increased k^o for $Fe(CN)_6^{3-}/4$. by at least a factor of 200 but increased PQ adsorption and C^o provide measures of microscopic surface area.

198. -,-, TITANIUM - EFFECT OF

Zhang, Deliang, Zeng, Xuling. Spectrophotometric study of quaternary complexes of titanium with pyrocatechol violet II. Fenxi Huaxue. 1989, 17(6), 520-3.

In chloroacetic acid buffer soln. (pH 3) contg. Cetyltrimethylammonium bromide (CTMAB), Ti(IV) forms two species

of green quarternary complexes with ascorbic acid (AA) (or triethanolamine (TEA) and pyrocatechol violet (PV). Based on equimolar series and equilibration shift methods the ratio of Ti(IV)/AA (or TEA)/PV/CTM AB are 1:1:2:4. The two species of complexes exhibit max. asborption at 735 nm. The molar absorptivity of the two systems is 1.0×10^5. The reactions of complex formation have higher contrast ($\Delta\lambda$ = 295 nm). Beer's Law is obeyed for 0.04-0.40 ppm of Ti(IV). The complexes are stable for >24 h. The effects of diverse ions on the detn. of Ti were examd. The system of AA may be applied to the detn. of Ti in some steel products. Without previous sepn.

199. -, METHODS-ABSORPTION - USE OF

Murty, D.S.R.; Tikoo, B.N. A novel method for eliminating matrix interferences in the determination of strontium by flame atomic absorption spectrometry. At. Spectrosc. 1987, 8(2), 79-80.

The use of a mixt. of asdorbic acid and tri-K citrate as a releasing agent in the detn. of Sr in silicate rocks eliminates the depressive effect on Sr absorbance in the presence of sulfate. The mixt. also serves as an ionization buffer in addn. to eliminating the effect of interferences due to Fe, Ca, Mg, and phosphate. The relative std. deviation and accuracy obtained are with in $\pm$ 2.4% and $\pm$5.5% resp.

200. -,-, DETERMINATION OF

Kiniwa, Toshikazu. Determination of ascorbic acid in urin. Kensa to Gijutsu. 1990, 18(7), 975-9.

A review, with lorefs., on methods for detn. of ascorbic acid in urin, esp. spectrometry, using indophenol, α,α'-dipyridyl, or Fe^{3+}-EDTA chelate complex-α,α'-dipyridyl, with resp. to their assay principles, reagents, assay procedures, and assay efficiency.

201. SPECTROPHOTOMETRY-ADSORPTION, ATOMIC-DETERMINATION OF

Ebdon, Les; Lechotycki, Andrzej. The determination of lead in environmental samples by slurry atomization graphite furnace atomic absorption spectrophotometry using matrix modification. Microchem. J. 1986, 34(3), 340-8.

Pb was detd. in 3 certified ref. materials (aquatic plant, olive, leaves, and mussel tissue) by direct slurry atomization-graphite furnace at absorption spectrophotometry. The importance of using ascorbic acid as matrix modifier was demonstrated, particularly to over come Ca interferences using 0.05 M ascorbic acid and aq. calibration stds., excellent agreement was found with certified values. The method is proposed for general application in environmental anal.

202. -, ELECTRODES-DETERMINATION OF

Mo, Jianwei; Jin, Duan; Pei, Jianhong; Zhao, Zaofan. Single-sweep polarographic determination of trace nitrite

in ferrous and ascorbic acid medium. Anal. Sci. 1990, 6(2), 251-5.

The $(FeNO)^{2+}$ complex can be formed in a soln. that contains ferrous ion (ammonium ferrous sulfate), nitrite (sodium nitrite) and ascorbic acid. With a dropping mercury electrode, this complex has a catalytic wave at -0.58 V which can be used for the detection limit of $5x10^{-8}$ M. The function of ascorbic acid is to reduce NO_2^- to NO quant. for complete formation of the electroactive complex. The mechanism of the electrode process was studied by linear sweep polarog., d.c. polarog. cyclic voltammetry and spectrophotometry. The anal. method was applied to sausage and water samples.

203. -, FRUITS-PREPARATIONS

Muralikrishna, U.; Murty, J. Adinarayana. Spectrophotometric determination of ascorbic acid in pharmaceutical preparations and fruit juices. Analyst (London) 1989, 114(3), 407-8.

Conditions were established for the detn. of ascorbic acid using phosphovanadotungstic acid as reagent and absorbance measurement at 360 nm. The method was applied to the detn. of ascorbic acid in pure form, pharmaceutical prepns, and fruit juices. The method is sensitive (2-24 μg mL^{-1} of ascorbic acid) and rapid and tolerates the presence of common ingredients usually found in fruit juices. The results obtained with the proposed method showed good agreement with those given by the std. method.

204. -, METHODS-DETERMINATION OF

Al-Ashmawi, M.I.; Metwally, M.F.; Saleh, H.M.; Mansour, O.A. Determination of ascorbic acid (vitamin C) in the presence of dehydro ascorbic acid using PMR spectroscopy. Zhonghua Yaoxue Zazhi. 1991, 43(5), 395-9.

A simple, rapid and efficient new quant. proton magnetic resonance method is achieved for the determination of ascorbic acid and its tablet form (vitacid C). The new method gives accurate and reproducible results compared to the official iodimetric method.

205. -,-,-,-

Hug, G. Abdul; Rao, S. Brahmaji. Application of the iron(III)-resacetophenone oximate complex for the determination of microamounts of ascorbic acid. Acta. Cienc. Indica Ser. Chem. 1981, 7(1-4), 37-9.

An indirect spectrophotometric method for the detg. 3.5-17.5 μg ascorbic acid is developed utilizing the purple color formed in the reaction between Fe(III) and resacetophenone oxime in NaOAC-HOAC buffer of pH 5. The absorbance of 4.50 nm decreased proportionately with the addn. of ascorbic acid in the range 3.5-17.5 μg. The decrease in the intensity of color is attributed to the redn. of Fe(III) to Fe(II). The molar absorptivity and sandell sensitivity are $4x10^3$ and 0.44 ug cm^{-2}, resp.

206. -,-,-,-

Sarkisyan, V.V.; Mnatsakanyan, Sh. Ts.; Markosyan, D.E. Photocolorimetric method for determination of silica in the presence of vanadium ions. Plast. Massy. 1990, (5), 73-4.

Si was detd. in the presence of excess vanadate (e.g. in solns. with VO_3-SiO_2 = 300:1 ratio) by spectrophotometry of reduced silicomolybdic acid at 590 nm. Ascorbic acid was used as the reducing agent instead of Mohr's salt. The interference of PO_4^{3-} and VO_3^- was suppressed by tartaric acid. The relative errors were within ± 20% for detg. 25-150 mg SiO_2/dm^3.

207. -,-, EXTRACTION

Koch, Siegfried; Peisker, Silke. Extraction-spectrophotometric determination of ascorbic acid with iron (III)/1,10-phenanthroline. Z. Chem. 1990, 30(5), 184-5.

An extn. spectrophotometric method is described for the detn. of ascorbic acid. At pH 4.0 Fe(III) and phenanthroline form $[Fe_2(OH)_4O(phen)_4]^{3+}$ which reacts with phen and ascorbic acid to give orange red $[Fe(phen)_3]^{2+}$, & dehydroascorbic acid, OH^-, and, H_2O, $[Fe(phen)_3]^{2+}$ is extd. with nitrobenzene in the presence of ClO_4^- and EDTA and its absorbance is measured at 510 nm. The working range, relative std. derivation, and detection limit are 2-10 µg, 3.19% and 0.3 µg ascorbic acid in 25 mL.

208. -,-,- DETERMINATION OF

Madan, Usha; Kakkar, L.R. Determination of molybdenum by extraction of its thiocyanate into ethyl methylketone. Talanta. 1982, 29(7), 623-5.

A simple, sensitive, and selective spectrophotometric method for detn. of MO is described. A soln. contg. 100 µg MO in 2.5 M HCl is treated with ascorbic acid and NH_4SCN and after 8 min it is shaken with an equal vol. of EtCOMe for 30 s. The absorbance of the complex is stable for 1 h. There is no interference from Re(VII), SO_4^{2-}, Cl^-, ACO^-, PO_4^{3-}, NO_3^-, $C_2O_4^{2-}$, citrate, or tartrate, and at least 5 mg U(VI), 10 mg Cr(III,IV), Th, or Ni, and 20 mg W (VI) can be tolerated. V(V) interference at the 500 µg level, and F-slightly decreases the absorbance.

209. -,-, OXIDATION

Muralikrishna, U., Murty, J. Adinarayana. Some observations on the sodium arsenate assisted oxidation of ascorbic acid by phosphomolybdic acid. Microchem. J. 1989, 40(3), 374-6.

A simple and direct spectrophotometric method for the estn. of ascorbic acid at the microgram level, based on its reducing action on phosphomolybdic acid in combination with sodium arsenate, was developed. In the pH range of 1.5 to 3.5, the detn. of ascorbic acid in its pure form down to 1 µg/mL. is possible. The time of reaction is 20 min and the wave length of measurement is 710 nm. The method tolerates the presence of common ingredients usually encountered in

in marketed fruit juices. The method is applicable to the detn. of ascorbic acid in pharmaceutical prepns. and marketed fruit juices.

The results compare well with the std. method.

210. -,-,- MEASUREMENT

Shaltsa, Helen D.; Tzakao, Olga, A.; Koupparis, Michael A.; Philianos, Skevos M. Specific differential spectrophotometric determination of ascorbic acid in plants using ascorbate oxidase. Anal. Lett. 1987, 20(10), 1079-91.

A specific enzymic differential spectrophotometric method is described and evaluated for the detn. of ascorbic acid in vegetables and medicinal plants. It is based on the absorbance measurement at 593 nm of the complex of ferrous ion with 2,4,6-tris (pyridyl)-5-triazine, which is produced by redn. of ferric ion by ascorbic acid Vs. a blank sample treated with ascorbate oxidase. The absorbance difference is linearly related to ascorbic acid from 10 to 100 µg/mL. The method was used to det. ascorbic acid in various plants. of the Greek flora. Acacia cyanophylla was found to be the richest source tested for ascorbic acid (89.6 mg/100 g of leaves). The method is very simple and can be used in routine anal.

211. -,-, POTENTIOMETRIC-DETERMINATION OF

Pandey, Naresh Kumar. Spectrophotometric and titrimetric determinations of ascorbic acid. Anal. Chem. 1982, 54(4), 793-6.

Three simple, rapid, and accurate methods of detg. ascorbic acid (I) 50-81-7 in simples at microgram levels were described. I was detd. spectrophotometrically at 336 nm, via a decrease in absorbance in $7x10^{-4}$ M tetrachlorobenzoquinone (chloranil) in 80% Me_2CO-H_2O (vol./vol./vol.) at room tem. visual and potentiometric methods were developed in the presence of EDTA and were accurate to ± 0.18 to ± 0.45%, with a std. deviation of 0.042-0.083. The proposed methods were successfully applied to pharmaceutical prepns. Strong reducing agents including most of the thiols, serine, glycine, alanine, citric, oxalic, and tartaric acids, glucose, sucrose, and maltose do not interfere, even when present, upto a 10^{-15} M excess of vitamin C. Hence resoln. of mixts. of vitamin C and thiols is possible, eliminating the use of a masking agent for thiols in other methods.

212. -,-, SELENIUM-DETERMINATION OF

Hussain, Zahid; Ahmad, Mahmood; Hussain, Sadiq; Hanif, Muhammad; Haque, Mian M. Izharul. Spectrophotometrid determination of selenium at trace levels. Sci. Int. 1990, 2(2), 133-5.

A spectrophotometric method is described for the detn. of selenium which is based on the color reaction between selenium and ascorbic acid having a max. absorption at 500 nm. The reaction is specific for selenium and obeys Beer's law with in the concn. of 1 μg to 100 μg/10 mL. This reaction provides the basis for a new working method for

the spectrophotometric detn. of Selenium in microgram quantities in routine anal.

213. -, REACTIONS-AMINES-DETERMINATION OF

Baylocq. D.; Majacherczyk, C.; Rabaron, A.; Pellerin, F. Action of ascorbic acid on primary amines and amino acids. Talanta. 1983, 30(1), 72-4.

The structure of the by-product obtained by the action of ascorbic acid on primary amines, e.g. n-butylamine and -amine acids eg. glycine, was detd. by ^{13}C NMR and IR spectrophotometry. The reaction is used for the spectrophotometric detn. of the amines, amino acids, and ascorbic acid. The chem. form is comparable to that of Ruhemann Purple obtained by the action of ninhydrin on α-amino acids.

214. -,-, CATALYSIS

Li, Youfen; Xie, Chunling. Spectrophotometric study on the reaction between palladium and $\alpha,\beta,\gamma,\delta$, -tetra-(4-dimethyl aminophenyl) porphine. Fenxi Huaxue 1989, 17(6), 545-7.

The complex reaction of $\alpha,\beta,\gamma,\delta$ -tetrakis (4-dimethylaminophenyl) porphine with palladium (II) in the presence of OP, sodium dodecylbenzenesulfonate, and ascorbic acid was studied. The water insol. porphine is a highly sensitive reagent for direct spectrophotometric detn. of ultramicro palladium (II). The molar absorptivity is 5.7×10^6 L mol^{-1} cm^{-1} at 436 nm. Beer's law was obeyed for 0-1.1 µg Pd/25 mL.

This method is the most sensitive method for the detn. of ultramicroamt. of Pd(II). Pd was detd. in the catalysts with satisfactory results.

215. -,-, EFFECT OF

Viraraghavan, Saroja. Ascorbic acid : a Jaffeinterference. Bull. Chem. Soc. Jpn. 1992, 65(4), 1101-8.

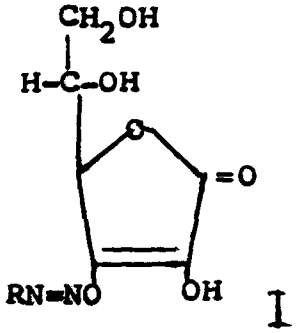
The effects of ascorbate, the interference of the Jaffe reaction was individually studied by polarog., spectrophotometry, and TLC. Picramic acid formed in all ascorbate; 28.4 m mol. dm^{-3} picrate test solns. which explained the obsd. pos. interference of ascorbic acid. No fluorescent product was formed in ascorbate : Picrate test solns. The reactivity of ascorbate : Picrate test solns. confirmed that ascorbate was a powerful reducing agent. 2-Furaldehyde which has been listed as one of the degradn. products of ascorbic acid is not identified under the exptl. conditions.

216. -,-, FORMATION

Doyle, Michael P.; Nesloney, Carey L.; Shanklin, Michael S.; Marsh, Carol A.; Brown, Kathlynn C. Formation and characterization of 3-O-arenediazoascorbic acids. New stable diazoethers. J. Org. Chem. 1989, 54(16), 3785-9.

L-Ascorbic acid reacts with arenediazonium salts to form stable compds. whose structures have been spectroscopically identified as 3-O-arenediazoascorbic acids I (R = p-O_2N-, P-Cl-, or P-$PhNHC_6H_4$). The pKa value of the

p- nitro- and p-chlorobenzenediazoderivs. are 10.2 and 10.1, resp., which also correspond to arenediazonium ion attachment of the 3-hydroxyl position of ascorbic acid.



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217. -,-, IRON

Koch, Siegfried; Ackermann, Gerhard. Reactions of iron(III) with ethylenediaminetetraacetic acid with enols. Z. Chem. 1987, 27(10), 374-5.

Complexation in Fe(III)-EDTA-enol ligand systems was studied by paper electrophoresis and spectrophotometry, color changes during the interaction of ascorbic acid, acetylacetone or acetoacetic ester with $FeY(OH)^{2-}$ (H_4Y=EDTA), are described.

218. -,-, KINETICS-MECHANISM OF

Xu, Jinhuang; Jordan, Robert B. Kinetics and mechanism of the reaction of aqueous iron(III) with ascorbic acid. Inorg. Chem. 1990, 29(21), 4180-4.

The kinetics of the reaction of iron(III) perchlorate with ascorbic acid in dil. aq. acid was studied by stopped-flow spectrophotometry at 16.1° under conditions of iron(III) (2-7) $x10^{-3}$ M), [ascorbic acid] ($2x10^{-4}$ M), and [H^+] (0.01-0.15 M). The reaction is assigned to formation of an Fe(III)-ascorbate complex consistent with previous observations.

However, the reaction is much faster than normally obsd. substitutions on aquairon(III). The dependence of the rate const. on H^+ indicates the formation of 2 protonated Fe(III) complexes, $Fe(AH)^{2+}$ and $Fe(AH_2)^{3+}$. The slower reaction involves redn. of Fe (III) and is inhibited by Fe (II). The rate law is consistent with the Fe(III)-ascorbate complex undergoing reversible electron transfer with $Fe(OH_2)_6^{3+}$ followed by oxidn. of the ascorbate radical by $Fe(OH_2)_6^{3+}$.

219. -,-, OXIDATION KINETICS

Hassan, Rafat, M. Kinetics and mechanism of selenium (IV) oxidation of ascorbic acid in aqueous perchlorate solutions. Croat. Chem. Acta, 1991, 64(2), 229-36.

The kinetics of oxides of L-ascorbic acid by selenium (IV) in aq. solns. of perchloric acid at a const. ionic strength of 1.0 mol. dm^{-3} has been investigated spectrophotometrically. A first order reaction in ascorbic acid and a fractional order with respect to selenium (IV) were observed. The rate of reaction was acid catalyzed. The results obtained at various hydrogen ion concens. indicate that the ascorbate anion plays a role in the reaction kinetics through formation of a complex ion intermediate. The activation parameters have been evaluated and a tentative reaction mechanism was suggested.

220. -, ULTRAVIOLET-JUICES-DETERMINATION OF

Fung, Ying, Singh; Luk, Shui, Fai. Determination of ascorbic

acid in soft drinks fruit juices. Part 2. Applicability of direct ultraviolet spectrophotometry with background correction. Analyst (London). 1985, 110(12), 1439-44.

The applicability of the proposed anal. procedure was studied, it has a good repeatability and could be used over a wide working range. The interference effects of 50 fruit juice components were studied individually and collectively in suitable combination as soft drink bases. No significant interferences were obsd. for most of the samples tested. The retiability of the method was established statistically by parallel detns. against established methods. The method was applicable to most fruit juices and soft drinks except those of that were deeply colored or contained high concns. of caffeine, saccharin, caramel, and tannic acid.

221. SPECTROSCOPY-METHODS-ION'S EXCHANGE-APPLICATION OF

Karve, Manjusha A.; Khopkar, Shripad M. Applications of liquid anion exchanges for the separation of Zirconium and hafnium. Anal. Sci. 1992, 8(2), 237-41.

Zirconium and hafnium were extd. with 0.1 M of Aliquat 3365 in toluene from 0.005 M of ascorbic acid at pH 4.0. Both of the metals were stripped with 2 M hydrochloric acid. Zirconium was detd. in the aq. phase spectrophotometrically with Arsenazo III at 650 nm; while hafnium was detd. with xylenol orange at 540 nm. The sepn. of zirconium from

hafnium was achieved by stripping hafnium with 9 M hydrochloric acid followed by stripping zirconium with 2 M hydrochloric acid. They were also sepd. from assocd. elements in multicomponent mixts.

222. -,-,-,-, KINETICS

Martinez, P.; Zuluaga, J.; Rodriguez, A.F. Kinetics and oxidation mechanism of L-ascorbic acid by chloropentammminecobalt (III) ions in acetic acid and basic aqueous solutions. Z. Phys. Chem. 1989, 270(3), 491-6.

The kinetics of the oxidn. of L-ascorbic by chloropentammine cobalt (III) ions was studied by means of a spectroscopic method in the acidic region, and with a stopped flow technique for rapid reactions in the alk. region. The oxidn. proceeds according to rate laws with an inverse proton dependent term and the addn. of neutral electrolyte causes a neg. salt effect in both pH zones. A mechanism involving the radical AH. for the acidic and the radical A for the basic region was used, and the derived rate laws agreed with the expt1. observations.

223. -, OXIDATION-APPLICATION OF

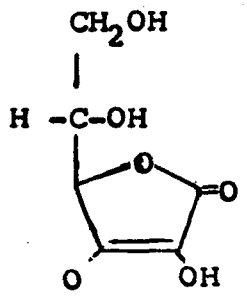
Acerete, Carmen; Garrigos, Lluis, Guilleme, Joaquin; Diez, Ernnesto; Aldaz, Antonio. Application of carbon-13 NMR spectroscopy to the elucidation of the electrochemical oxidation mechanism of the L-ascorbic and D-araboascorbic acids. Electrochim. Acta. 1981, 26(8), 1041-5.

The electrochem. oxidns. of L-ascorbic and D-arabino-ascorbic acids were examd. in acid and base medium by ^{13}C NMR. The proposed rupture of the furanose rings in basic medium at pH~9 (Aldaz, et al, 1986) does not occur : the electrolysis products from basci medium are indentical to those from acid medium when the pH of the latter is increased after electrolysis to~11, suggesting the oxidn. mechanisms in both acid and base medium are similar. The ^{13}C chem. shifts of the oxidn. products from acid and base medium were assigned.

224. -, REACTIONS-DIBROMOPINACOLONE

Parish, Harlie A.; Gilliom, Richard D. The reaction of 1,1-dibromopinacolone with ascorbic acid. Carbohydr. Res. 1982, 102(1), 302-7.

The title reaction gave 36% I whose structure was confirmed by elemental anal. and chem. and spectral data. A mechanism for the reaction is proposed.



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225. STORAGE-CHANGES, SUBSTANTIAL-INFLUENCE

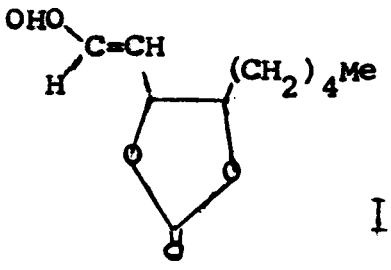
Asker, A.F.; Harris, C.W. Influence of storage undertropical conditions on the stability and dissolution of ascorbic acid tablets. Drug.Dev. Ind.Pharm. 1990, 16(1), 165-74.

Ascorbic acid tablets stored at 40° and 90% relative humidity (R.H.) demonstrated substantial changes in chem. as well as phys. stability including color, disintegration time, hardness and dissoln. rate. Tablets stored at 40° and 35% R.H. showed virtually no change in chem. stability and hardness but measurable changes in disintegration time and dissoln. rate. Moisture appeared to be a significant contributing factor to the enhancement of the chem. and phys. instability of ascorbic acid tablets.

226. SYNTHESIS-FATTY ACID - METABOLITES

LeMerrer,Y.; Gravier-Pelletier, C.; Dumas, J.; Depezay, J.C. Chiral α-hydroxy- and α,β-dihydroxy-aldehydes from D-isoascorbic and L-ascorbic acids. Useful precursors for the synthesis of fatty acid metabolites. Tetrahedron Lett. 1990, 31(7), 1003-6.

The four possible stereoisomers of α,β-dihydroxy aldehydes I useful for the synthesis of fatty acid metabolites, are synthesized via epoxy-tetrols derived from D-isoascorbic and L-ascorbic acids. The general method described allows the synthesis of chiral -hydroxy aldehydes as well.



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227. -, GERMINATION - EFFECT OF

Leung, Cecilia T.; Loewus, Frank A. Ascorbic acidinpollen : conversion of L-galactono-1,4-tactoneto L-ascorbic acid by Lilium longiflorum. Plant Sci. (Limerick Ire) 1985, 39(1), 45-8.

The L-ascorbic acid (AA) content of pollen from 3 cultivars of L- longiflorum was 260-280 µg/g fresh wt. of pollen. During germination. AA content gradually decreased, reaching 70% of the original value of 6 h. Pollen germinated in media contg. 0.29 M D-glucose (an osmoregulator and C source) failed to synthesize AA, but pollen germinated in 0.29 M pentaerythritol (non metabolizable osmoregulator) supplemented with L-galactonol,4-Lacton (L-Gal AL) did form AA, dependent upon the concn. of the lactone. Lycorine inhibited germination but had negligible effect on the conversion of L-Gal AL to AA.

228. -, GUINEA PIOS-TREATMENT

Johnston, P.A.; Chahl, Loris A. Chronic treatment with ascorbic acid inhibits the morphine with drawal response in guinea pigs. Neuro-Sci. Lett. 1992, 135(1), 23-7.

The effects of ascorbic acid (AA) were investigated on the morphine with drawal response to guinea-pigs, a species which shares with man the inability to synthesize AA. Chronic pretreatment of guinea-pigs with AA. 1 g/L, in drinking water for 3 days or AA 200 mg/kg S.C. 3 times daily for 3 days, markedly reduced the locomotor and behavioural

withdrawal responses of guinea pigs given naloxone hydrochloride, 15 mg/kg S.C. 2 h after a single dose of morphine sulfate, 15 mg/kg S.C. AA, 1 g/Kg given i.p. 30 min before morphine had no effect on morphine withdrawal. However, intracerebroventricular injection of AA, 1 u mol, 30 min before naloxone ethanced morphine withdrawal. It is conducted that chronic but not acute administration of AA inhibits opiate with-drawal.

229. -, METHODS-PREPARATION

Sekine, Mitsuo; Futatsugi, Tetsuak; Hata, Tsujiaki; Cramer, Friedrich. Silyl phosphites. 21. A new method for the synthesis of L-ascorbic acid 2-O-phosphate by utilizing phosphoryl rearrangement. J. Org. Chem. 1982, 47(18), 3453-6.

A stabilized form of vitamin C, L-ascorbic acid 2-O-phosphate (I) was successfully prepd. by a new method via a fully trimethylsilylated L-ascorbic acid (II) which was prepd. in high yield by Silylation of L-ascorbic acid with isomerized during distin. to III. Addn. of $P(OSiMe_3)$; R = $OSiMe_3$, R' = $P(O)(OSiMe_3)_2$ which underwent thermal rearrangement to give a mixt. of bis (trimethylsily)-3,5,6-tris-O-(trimethylsily)-L-ascorbic acid 2-O-phosphate and its 3-O-isomer in 88:12 ratio. Treatment of the mixt. with cyclohexylamine-MeOH gave selectively tricyclohexylammonium I in 53% yield.

230. -, REACTIONS

Liang, Yun Teh S.; Liu, Xue Sheng; Seib, Paul A. Synthesis of D-erythroascorbic acid. J. Carbohydr. Chem. 1990, 9(1), 75-84.

D-Erythroascorbic acid (I) was synthesized from D-glucose in four steps. I and L-ascorbic acid were lost at approx. equal rates from aq. soln. at pH 7 in the presence and absence of added cupric ion.

231. -,-,

Lia O, Ming Long; Wang, Xiaoying; Chung, Clara; Liang, Yun-Teh; Seib, Paul A. Synthesis of L-ascorbate-6-phosphate. Carbohydr. Res. 1988, 176(1), 73-7.

L-Ascorbate-6-phosphate (I) was prepd. in aq. medium at pH 8.5-9.0 by reaction of 6-bromo-6-deoxy-L-ascorbic acid with hydrogen phosphate ion at 25°. It was not detected by liq chromatog. in fresh spinach leaves nor in mouse brain or lungs at a conc. above 30 μg/100 g of wet tissue.

232. -,-, AMINO ACIDS

Abe, Katsuo. Stabilizing activity to L-ascorbic acid of 3-methoxyphenyl-2-thiohydantoin amino acid and 3-ethoxyphenyl-2-thiohydantoin amin acid. Kochi Joshi Daigaku Kiyo, Shizen Kagaku-hen. 1989, 37, 13-24.

All of the 54 synthesized methoxy- and ethoxyphenyl-2-thiohydantoins I (RO = 2-3-, or 4-MeO,-EtO; R^1,R^2 = H, alkyl) inactivated the autoxidn. of L-ascorbic acid (II)

in the presence of Cu^{2+}, thus stabilizing II. Decreases in the stabilizing activity for II. Were obsd. with the compds. having 2-RO substituents due to the Steric and electronic effects of the substituents on the electron d. of the S atom. I (RO = 3-EtO, R^1 = H, R^2 = Bu, CHMeEt) showed the highest activity among the tested compds. in the range of pH 4.0-7.0

233. -,-, ANALOG

Al-Hakim, Ali H.; Haines, Alan H. Studies towards the synthesis of analogs of L-ascorbic acid. Carbohydr. Res. 1983, 121, C_6-C_9.

Ascorbic acid analog I (R = R^1 = Cl, Br; R = N_3, Sph, R^1 = Cl) were prepd. Thus Horner-Emmons reaction of mucochloric acid (II) with Mediethyl phosphonoacetate gave (2Z, 4E)-MeO_2CCH : CHCCl : $CClCO_2H$, which on refluxing in m-xylene cyclized to I (R = R' = Cl), which on reaction with NaN_3 or PhSK gave I (R = N_3, SPh, R^1=Cl),resp.

234. -,-,-

Mokhtar, Hassan; Feid-Allah, Hassan. Synthesis and reactions of arylimino ascorbic acid analogs. Pharmazie. 1981, 36(1), 751-3.

Treating aq. KCN and Na_2CO_3 with $OHCCHONaHSO_3$, then arom. aldehydes gave tetronimides I (Rn = 4-Br, 4-Me, 2-MeO, 3,4-OCH_2O) which were acylated to butyriminol acetone II (Rn = 4-Br, 4-Me, 3,4-OCH_2O; R_1 = Me, Ph,

3-$MeOC_6H_4$), oxidized with HNO_2 to dioxobutyrolactones III (Rn as for I), converted to acylhydrazone IV (Rn = 4-Me, 4-Br; R_2 = H,Cl, NO_2, Z = CO), arylhydrazones IV (Rn = 4-Me, 4-Br, 3,4-OCH_2O ; R^2 = H, SO_2NH_2, NO_2; Z = bond) and I (Rn = 4-Me, 4-Br, 3,4-OCH_2O; R^2 = NO_2) and schiff bases (VI) (Rn as for V), and cyclized to aquinoxalines VII (Rn as for V).

235. -,-, CATALYSIS-PREPARATION OF

Koch, Hans J.; Stuart, Ronalds. The preparation of some C-deuterated L-ascorbic acids. Anal. Chem. Symp. Ser. 1982, 11(stable Isot.) 731-4.

2,3-O-Isopropylidine-α-L-xylo-2-hexulofuranose-6,6-6-d_2 and Meα-L-xylo-2-hex-ulopyranoside-1,1,3,4,5-d_5- were prepd. from the unlabled compds. by catalytic exchange in boiling D_2O contg. deuterated Raney Ni. Treatment with acidic Me_2CO gave the deutrated 2,3:4,6-di-O-isopropylidene-α-L-xylo-2-hexulofuranoses (diacetone-L-sorbases) which are intermediates in the Reichstein Gnissner synthesis of L-ascorbic acid.

236. -,-, EFFECT OF

Mohan, D.; Radhakrishnan, Ganga, Rajadurai, S. Synthesis of Casein-G-poly (vinyl acetate). II. J. Polym. Sci., Polym. Chem. 1983, 21(11), 3041-53.

Poly (vinyl acetate was grafted on Casein in the presence of $K_2S_2O_8$-ascorbic acid (I) [50-81-7] . The effect

of process variables on the rates of conversion of monomer, graft polymn., and homopolymn., percent grafting and grafting efficiency were compared with those in initiation by $K_2S_2O_8$ alone. An increase in I concn. and temp. favoured homopolymn. overgraft polymn. Grafting effiency was greater without I.

237. -,-, EFFICIENCY

Saibaba, Racha; Sarma, Mallela, S.P.; Abushanab, Elie. The chemistry of L-ascorbic and D-isoascorbic acids. 3. Efficient syntheses of pure R- and S-1,2-O-isopropylidene-1,2-4-butanetriols. Synth. Commun. 1989, (19(17), 3077-86.

Both enantiomers of 1,2-O-isopropylidene-1,2,4-butanetriol, useful as chirons, were prepd. by two different and simple methods starting from readily available L-ascorbic and D-isoascorbic acids.

238. -,-, ISOLATION

Liao, MingLong; Seib, Paul A. A stable form of vitamin C: L-ascorbate 2-triphosphate. Synthesis, isolation, and properties J. Agric. Food Chem. 1990, 38(2), 355-66.

L-Ascorbate 2-triphosphate (I) was synthesized by phosphorylating L-ascorbate (II) with Na trimetaphosphate. The regioselectivity of the reaction was optimum (95% of 2-phosphorylation) when 1.62 M II was treated with 1.3 equiv. of NaP_3O_9 at pH 10.4-10.7 and 35° for 24 h or 55° for 5 h. The reaction yielded 4% unreacted II.

86% I, 3% L-ascorbate 2-diphosphate, 3% of a 4,5-elimination compd., and 1% L-ascorbate 2-monophosphate. The phosphates were readily hydrolyzed by acid phosphatase to give stoichiometric release of II. I appeared to be equiv. to II as a source of vitamin C in guinea pigs.

239. -,-, OXIDATION

Awad, Laila; Mousaad, Ahmed; El-Ashry, El-Sayed H. Synthesis of 3-(L-threo-glycerol-1-yl)-6,7-dimethylpyrazolo 3,4-b quinoxalines. J. Carbohydr. Chem. 1989, 8(5), 765-7.

Reaction of dehydro-L-ascorbic acid with 1,2-diamlno-4,5-dimethylbenzene and arylhydrazines $RNHNH_2$ (R = PhC_6H_4Me-O, C_6H_4Me-P, C_6H_4Cl-m, C_6H_4Cl-P afforded the corresponding hydrazonoquinoxalinones I (R = same). Their dehydrative cyclization gave the title compds II. Whose acetylation and periodate oxidn. were studied.

240. -,-,-

Nandi, Anuradha; Chatterjee, I.B. Scavenging of superoxide radical by ascorbic acid. J. Biosci. 1987, 11(1-4), 435-41.

Using AcH and xanthine oxidase as the source of superoxide radical, the 2nd order rate const. for the reaction between ascorbic acid and superoxide radical was estd. to be 8.2×10^7 $M^{-1}S^{-1}$. In rats, the av. tissue concn. of ascorbic acid was the order of 10^{-3} M and that of superoxide dismutase was of the order of 10^{-6} M. Thus, taking together both the rate consts. and the tissue concns. the

efficacy of ascorbic acid for scavenging superoxide radical in animal tissues appears to be better than that of superoxide dismutase. The significance of ascorbic acid as a scavenger of superoxide radical has been discussed from the point of view of the evolution of ascorbic acid synthesizing capacity of terrestrial vertebrates.

241. -,-,-, ANALYSIS

Gan, Lixian; Seib, Paul A. Synthesis of D-erythroascorbic acid from D-glucose. Carbohydr. Res. 1991, 220, 117-25.

Reaction of a 4:1 mixt. of D-ribono- and D-arabinono-1,4-lactones with PhCHO and HCl gave 59% ersst. benzylideneribonolactone I (R = H). I was oxidized with to its 2-keto derivs. I (R = OH) (II) in 76% yield. Acid-catalyzed methanolysis of II gave a mixt. of products, which upon tautomerization in hot methanolic sodium acetate followed by removal of sodium ions gave 78% D-erythroascorbic acid (III). The overall yield of III starting from D-glucose was 20%.

242. -,-,-, VITAMIN C

Poss, Andrew J.; Better, Randolph K. Vitamin C in organic synthesis reaction with P-hydroxybenzyl alchhol derivatives. J. Org. Chem. 1988, 53(7), 1535-40.

The reaction of L-ascorbic acid with P-hydroxybenzyl alc (I) yields 2-(p-hydroxybenzyl)-3-ketohexuilosorbic acid lactone (II; $R^1 = R^3 = R^4 = H$, $R^2 = OH$). This reaction

proceeds by the addn. of the conjugate base of ascorbic acid to the protonated quinone methide derived from I. The total synthesis of delesserine (II; R^1 = Me, R^2 = OH, R^3 = R^4 = H), methylrhodomelol (II; R^1 = Me, R^2 = R^3 = OH, R^4 = Br), and rhodomelol (II; R^1 = H, R^2=R^3 = OH, R^4 = Br), was accomplished by this metholol. Treatment of ascorbic acid with 3-hydroxy-3-(p-hydroxyphenol) propionic acid affords a mixt. of dilaspirolactone aglycon III and ester lactone IV.

243. -,-, REDOX

Salinas, F.; Garcia Sanchez, F.; Genestar, C. 1-Amino-4-hydroxyanthraquinone as redox fluorescent indicator. Afinidad. 1982, 39 (379), 261-2.

Ascorbic acid or $NaASO_2$ solns. can be titrated with 0.1 N $KBrO_3$ in acid soln. by using 0.3-0-4 mL 0.1% 1-amino-4-hydroxyanthraquinone as indicator. The end point is the appearance of yellow fluorescence (360 nm).

244. -,-, RESONANCE SPECTRUM

Lu, Pao Wen; Lillard, Donald W.; Jr.; Seib, Paul A.; Kramer, Karl J. Liang, Yun-Teh. Synthesis of the 2-methyl ether of L-ascorbic acid : Stability, vitamin activity, and carbon-13 nuclear magnetic resonance spectrum compared to those of the 1- and 3-methyl ethers. J. Agric. Food Chem. 1984, 32(1), 21-8.

Reaction of L-ascorbic acid with Me_2SO_4 (16 equiv) at pH 10.5 and 60°C gave 76% cryst. 2-Me ether (I) alone with 15% of a by product. The byproduct formed a lactone during isolation and was tentatively identified as II. II was quant. converted to I in boiling MeOH-HCl. 5,6-O-Isopropylidene-L-ascorbic acid was 2-methylated by Me_2SO_4 at pH 10.5 and 60°, and removed of the 5,6-acetal blocking group gave I in 85% yield from L-ascorbic acid. I showed only marginal vitamin C activity in the tobacco horn worm and guinea pig. The structures of the 1-2-, and 3-Me ethers were confirmed by ^{13}C NMR and UV spectroscopy under aerobic conditions at pH 7, the order of stabilities of the Me ethers was $2 \gg 3 > 1$.

245. -,-, SURFACTANTS - EFFECT OF

Wojtowicz, Anna; Zajecki, Janusz; Kramarz, Wanda. Effect of surfactants on duration of ascorbic acid synthesis. Przem. Chem. 1990, 69(5), 210-11.

Ascorbic acid of ~95% purity was synthesized with ~90% yield from diaceto-2-ketogulonic acid by enolization in $C_2H_2Cl_2$ in the presence of HCl and 0.1-0.3% Tween 20 or Na laurylsulfate. Addn. of a surfactant decreased the reaction time from 40 to 12 h. Mixing conditions could be improved by the addn. of 1-10 vol.% acetone or increasing the temp. from 335 to 340 K.

246. -,-, TEETH EFFECT OF

Homma, Akihiko. Effect of ascorbic acid on periodontal ligament fibroblast of human deciduous and permanent teeth. Kanagawa Shigaku. 1990, 25(3), 273-83.

This study attempts to explore the effect of ascorbic acid (ASA) and L-ascorbic acid-2-phosphate (ASA-P) on the cell proliferation and differentiation of the periodontal ligament of deciduous teeth (HPLF-Y) and of permanent teeth (HPLF), and the ability of conditioned medium from human fibroblasts derived from these 2 types of ligaments to stimulate cell attachment and spreading according to the methods described by S. Saito et al. (1989). The effect of ASA and ASA-P on DNA synthesis was obsd. as 15-20% enhancement in composition with that of the controls for both HPLF-Y and HPLF, with exception of ASA-P for HPLFat the 7th day of cell culture. The alk. phosphatase (AL phase) activity of HPLF-Y and HPLF at confluent phase was stimulated significantly by presence of ASA and ASA-P.

By morphol. observation, the cell spreading activity of the conditioned medium of HPLF-Y exposed to ASA-P was higher than that of exposed to ASA. An induction of the cell attachment factors from HPLF-Y was enhanced intensively by the treatment with ASA-P. Therefore, ASA-P may regulate intensively the proliferation and differentiation of HPLF-Y, in terms of DNA synthesis and ALphase activity including the enhanced secretion of attachment and spreading factors.

247. -,-, VIVO-CONTROL MEASURE

De Gara, L., Tommasi, F.; Liso, R.; Arrigoni, O. Ascorbic acid as a factor controlling its biosynthetic pathway in vivo. Boll. Soc. Ital. Biol. Sper. 1989, 65(10), 959-65.

The capacity of ascorbic acid biosynthesis in potato tuber tissue is closely correlated with the ascorbic acid conent of the cells; the lower the endogenous content of ascorbic acid, the greater its biosynthesis. At the highest level of ascorbic acid found in the cells, the biosynthetic capacity is virtually zero. In these conditions, adding glucose (the first precursor of ascorbic acid) has no effect whatsoever, whereas adding galactono -Lactone (the least precursor) induces a high rate of ascorbic acid synthesis. It is suggested that ascorbic acid biosynthesis is subjected to a regulatory mechanism in vivo which controls an initial step in the biosynthetic pathway. The last step in this pathway, catalyzed by galactone oxides, is never blocked and, moreover, its activity is greater than that of the preceding steps.

248. -, SYSTEMS, REDOX

Mohan, D.; Radhakrishnan, Ganga; Rajadurai, S. Synthesis of Casein-g-poly (methyl acrylate) II. J. Appl. Polym. Sci. 1990, 39(7), 1507-18.

The synthesis of Me acrylate-grafted casein was studied using the $K_2S_2O_8$-ascorbic acid redox system. The effect of synthetic variables was investigated in the light

of rates of conversion of monomer, graft copolymn. and homopolymn., percent grafting, and grafting efficiency. The results were compared with the system initiated by pure $K_2S_2O_8$ alone. The graft polymer was used to coat leather.

249. TAXONOMY ANGIOSPERMS

Jones, Eleri, Hughes, R.E. Foliar ascorbic acid in some angiosperms. Phytochemistry. 1983, 22(11), 2493-9.

The ascorbic acid content of the leaves of 213 species of angiosperm was detd. The nutritional and taxonomic significance of the results is discussed.

250. TISSUES-HUMAN FATAL-OBSERVATIONS

Zalani, Sunita; Bharaj, Bhupinder Singh; Rajalakshmi, R. Ascorbic acid and reduced glutathione concentration of human fetal tissues in relation to gestational age, fetal size and maternal nutritional status. Int. J. Vitam. Nutr. Res. 1987, 54(4), 411-9.

Studies were carried out on ascorbic acid and GSH concn. in human fetal tissues with the progress of gestation. The GSH concn. in human fetal liver and adrenal showed a decline during late gestation, the decline in the brain being earlier. This is consistent with the fall in ascorbic acid conc. in all tissues during late gestation. GSH concn. and GSH/ascorbic acid ratio was significantly lower in the low income group than that the high income

group, confirming previous observations that state of nutrition may influence cellular GSH.

251. TITRANT-FRUITS-JUICES-METHODS-DETERMINATION OF

Pathak, V.N.; Singh, A.L.; Shukla, I.C. Microgram Determination of Ascorbic Acid in pharmaceutical preparations, Urine, Blood plasma and Fruit juices. J. Indian Chem. soc. July 1984, 61(7), 652-3.

Various oxidants have been used for the titrimetric 1-10 and colorimetric 11-13 determination of ascorbic acid. Many of these methods suffer from the drawback of longer reaction time and lesser sensitivity. The standard method[11,14] used in pathological laboratories involves rigid control of temperature (37^{o}), a reaction time of 3 hours and a complicated procedure.

252. -, IRON-DETERMINATION OF

Zheng, Daben. Use of ascorbic acid as titrant for iron determination. Fenxi Shiyanshi. 1988, 7(12), 59.

Fe^{3+} was detd. by titrn. with ascorbic acid using KCNS-valamine Blue B as an indicator at 0.15 mol/L acidity. The end point was indicated by a change of the blood red color to colorless. The relative std. derivation was 0.25% and the recovery was 98-101% for 20 mg Fe added.

253. TITRATION, AMPEROMETRIC ELECTRODES

Wang, Joseph; Freiha, Bassam A. Amperometric titration employing hydrodynamic modulation for end point detection.

Anal. Chem. 1982, 54(7), 1231-3.

End points of titrns. were located by hydrodynamic modulation voltammetry. A glassy C disk was used as the working electrode, with stopped rotation and stopped stirring amperometry as modulation procedures. As an example, ascorbic acid was titrated by I at the micro and submicro molar concn. Levels with adequate precision and accuracy. By combining the selectivity of the titrn. reaction with the sensitivity of the hydrodynamic modulation end point detection it is possible to measure law concn. of ascorbic acid in the presence of other species (eg. Catechols) with similar oxidn. potentials. An applicability of this method is demonstrated by the detn. of vitamin C in multivitamins and iron tables. The advantages of this technique over other electrochem. end point detection procedures are discussed.

254. -, BIAMPEROMETRIC-DETERMINATION OF

Joshi, S.N.; Kulkarni, A.G.; Deshmukh, G.S. Biamperometric determination of copper, silver and gold with ascorbic acid. Ananol. Chim. Acta. 1985, 167, 399-401.

The simultaneous detn. of milligram amts. of Cu, Ag, and Au in mixts. is described. Ascorbic acid is added in excess and back-titrated biamperometrically with std. KIO_3 soln. Mixts. can be analyzed by using pptn. and masking.

255. -, COMPOUNDS, ORGANIC-DETERMINATION OF

Verma, Krishna K.; Gupta, Anil K.; Bose, Sameer. Determination of certain mixtures of organic compounds with N-bromosuccinimide. Ann. Chim. 1982, 72(3-4), 213-16.

N-Bromosuccinimide was used as a titrant in detg. ascorbic acid, d-biotin, crysteine, glutathione, sulfathioazole, and lanthionine by using either KI and starch (method A) or methyl red (method B) indicator. Mixts. of sulfathioazole and ascorbic acid, biotin and glutathione, cryteine and lanthionine, and crysteine and ascorbic acid were analyzed either method A or B. Tetrathionate preoxidn. or cyanoethylation of cysteine was used when required.

256. -, IMPOTENTIOMETRIC-ELECTRODES-INVESTIGATIONS

Pastor, T.J.; Paster, M.M.; Simonovic, Z.; Szepesvary, E. Behaviour of membrane graphite electrodes inpotentiometric titrations of reducing subtances with bromine in acetic acid. Talanta. 1982, 29(6), 521-4.

A Pt electrode, a Radelkis OP-C 7111 graphite electrode, and a lab-prepd. silicone-rubber based membrane graphite electrode were used in potentiometric titrns. of reducing substances with Br in AcOH. In detns. of hydroquinone, 2-methylhydroquinone, 2-chlorohydroquinone, and ascorbic acid, the Radelkis electrode showed the greatest sensitivity. The advantage of the lab.-pred. membrane graphite electrode lay in its rapid attainment of stable

potential values. Titrns. were improved by addn. of KOAc to the solns. analyzed. Titrns. of As and Sb, and the effect of water and acetic anhydride on the results were also investigated.

257. -, METHODS-BIAMPEROMETRIC-ELECTRODES

Singh, T.B.; Prasad, B.B. Determination of ascorbic acid, hydroquinone and thiourea by titration with copper perchlorate in nonaqueous medium using platinum graphite biamperometric indication. Chem. Anal. 1981, 26(3), 541-4.

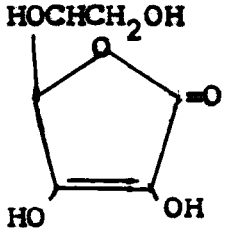
A biamperometric method with Pt-graphite electrode system for the detn. of ascorbic acid, hydroquinone, and thiourea and its derivs. is described. The samples were dissolved in MeCN and titrated with $Cu(ClO_4)_2$ soln. in the same solvent. In all cases well defined titrn. curves were obtained. The error ranged from -0.79 to +0.80%.

258. -,-, BROMOMETRIC DETERMINATION OF

Borisevich, S.N.; Savel'eva, G.I. Bromometric method for simultaneous determination of iodides and ascorbic acid. Farmatsiya. 1982, 31(4), 66-7.

Ascorbic acid (I) [50-81-7] and KI were simultaneously detd. by titrating a boiling mixt. of 1.1. mL. formulation and 5 ml $HCl-H_2O$ (1:1) and ~2 mL starch with 0.05 N $KBrO_3$ to a stable light blue color. The mixt. was cooled and titrated with the same titrant till a (grayish) brown color was transformed to lemon yellow. Initially,

I_2 obtained by the oxidn. of I^- in $KBrO_3$ medium oxidizes I and the excess I^- gives the blue color with starch followed by further titrn. of I^- with $KBrO_3$ to give a lemon yellow color. The method gives reproducible results.



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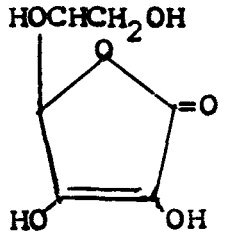
259. -,-, DETERMINATION OF

Rao, N. Venkateswara; Rao, K. Mohana. Titrimetric determination of ascorbic acid with chloramine-T using oxazine dyes as indicators. J. Indian Chem. Soc. 1981, 58(11), 1127-8.

Ascorbic acid (I) [50-8-7] was detd. Titrimetrically with chloramine-T using different oxazine dyes as indicators in neutral and acid media. I soln. (4-10 ml, 0.1 N) was treated with 1:1 HCl or AcOH and dild. to 50 ml, and 0.2 mL (0.1%) indicators soln. added. The mixt. was titrated against chloramine-T. This method can be used for 1 detn. in com. pharmaceuticals.



I

260. -,-, REDOX

Rao, N. Venkateswara; Kumari, I. Jyothsna. Azine dyes as redox indicators in titrations with N-bromosuccinimide. J. Inst. Chem. 1987, 59(4), 179-80.

Fourazine dyes, Nuetral Red, Neutral violet, Azo carmine G, and Wool Fast Blue GL (color Index No. 50030,

50040, 50085 and 50320 resp.) were proposed as redox indicators in titrns. of As(III), Sb(III), ascorbic acid, hydroquinone, and hydrazine with N-bromosuccinimide. The method developed for titrn. of ascorbic acid was applied for its detn. in com. pharmaceutical prepns.

261. -,-, THERMOMETRIC-DETERMINATION OF

Mayers, Anthony, R.; Taylor, Colin G. Determination of ascorbic acid in multivitamin tablets by thermometric titrimetry with Cerium (IV). Analyst (London). 1987, 112(4), 507-9.

Ce(IV) sulfate in aq. H_2SO_4 was used as a titrant for the thermometric detn. of ascorbic acid (I) [50-81-7]. The method was applied to the anal. of multivitamin tablets contg. 10-30 mg I per tablet, and was free from interference from tablet excipients. Comparative analysis of 2 types of multivitamin tablets was carried out using these method, 2, HPLC methods and visual titrimetry [Ce(IV) ammonium sulfate]. The precisions of the thermometric method and the HPLC methods are similar and acceptable. The presence of vanillin was identified as a cause of pos. bias in the visual method. The thermometric method in performance to other thermal methods for the detn. of I. The relative std. deviation is 0.6-4%.

262. -,-, VOLUMETRIC-DETERMINATION OF

Rao, B.V.; Raoot, Sarada. Potentiometric and visual as carbinometric determination of manganese (III). Indian

J. Technol. 1984, 22(3), 117-18.

A simple volumetric method was developed for the detn. of 4-16 mg Mn (III) in 2.5 M H_2SO_4 medium by using ascorbic acid as reducing titrant. H_2PO_4 was used to stabilize Mn(III). Na diphenylamine sulfonate was used as indicator in the visual titrn., a clear potential decrease of 300-350 mV was obsd. as an indication of the equivalence point in the potentiometric titrn. V(V) and Cr(III) affect the detn. The method was applied to the detn. of Mn in Mn steel, ferromanganese, Cu-Mn and Al-Mn alloys and Mn ore.

263. -, OXIDIMETRIC PROCEDURES

Rangaswamy; Yathirajan, H.S. Potassium N-iodobenzene sulfonamide as an oxidimetric titrant. in aqueous medium. Curr. Sci. 1981, 50(24), 1057-8.

KN-iodobenzene sulfonamide (iodamine-B) is proposed as an oxidimetric titrant in aq. medium. The general conditions for its use and procedures for detg. hydrazine, ascorbic acid, hydroquinone, semicarbazide, thiourea, As(III), Sb(III), and Ti(I) by a direct titrn., and this sulfate, xanthate, dithocarbamate, and thiosemicarbazide by a back-titrn. procedures are described.

264. -, POTENTIOMETRIC-ACETIC ACID, AQUEOUS

Jayasree, N.; Indrasenan, P. Some analytical applications of N-chlorosuccinimide : direct potentiometric and visual

titrations in aqueous acetic acid medium. Indian J. Chem. Sect. A 1986, 25A(9), 852-4.

N-chlorosuccinimide was used as an oxidimetric titrant in aq. acetic acid medium. Both direct potentiometric and visual titrns. of reductants such as As(III), Sb(III), Fe(II), hexacyanoferrate (II), iodide, sulfite, ascorbic acid, hydroquinone, hydrazine and its derivs., aniline, phenol, sulfanilic acid, P-aminobenzoic acid, oxine and its metal derivs., and anthranilic acid and its metal derivs. were developed.

265. -, REACTIONS METHODS

Campanella, L.; Paoletti, A.M. The reaction between nitric and ascorbic acid. Rass. Chim. 1982, 34(1), 15-17.

The reaction between ascorbic acid and nitrite was studied for the purpose of detg. the latter. An indirect titrimetric method for detg. nitrite is based on adding excess ascorbic acid soln. to the nitrite soln. followed by titrating the unreacted ascorbic acid with IO_3^-/I^- soln. in acid medium. The end point can also be monitored by the dead stop technique. Nitrite, 0.5-100 mg was detd. with an error 1-1.5% Cl^-, F^-, SO_4^{2-}, Fe(III), and Al do not interfere Cr, Mn, and strong oxidizing agents, such as V(V), Ce(IV), H_2O_2, bromate, IO_3^- and I interfere. The technique was used for detg. NO_2^- and NO_3^- in their mixts.

266. TREATMENTS-PATIENTS MEDICO PSYCHIATRIC, FLUID CEREBRO-SPINAL-USE OF

Degrell, Istvan; Nagy, Erzsebet. Concentration gradients for HVA, 5-HIAA, ascorbic acid, and uric acid in cerebrospinal fluid. Biol. Psychiatry. 1990, 27(8), 891-6.

Concns. of homovanillic acid (HVA0, 5-HIAA, ascorbic acid, and uric acid in the lumbar and cisternal cerebrospinal fluid (CSF) were measured in psychiatric and neurol. impaired patients. The conc. of HVA is 6.1 fold and that of 5-HIAA is 2.7-fold higher in cisternal than in lumber samples, the cisternal level of uric acid is half that of the lumber region, and no significant differences are found in ascorbic acid concns. correlation between lumber and cisternal metabolite concns is high for 5-HIAA and ascorbic acid, and is less for HVA and uric acid. In cisternal CSF there is a significant correlation between levels of HVA and 5-HIAA, of 5-HIAA and ascorbic acid, and of 5-HIAA and uric acid.

267. WATER-ANALYSIS METHODS, IODOMETRIC DETERMINATION OF

Sarin, R.; Pande, S.P. A modified iodometric method for determination of Selenium in water. J. Inst. Chem. 1983, 55(5), 205-8.

A modified method for the detn. of Se in water, based on iodometry involving ascorbic acid [50-81-7] as the titrant, is described which is much more sensitive

than the method involving Na thiosulfate as titrant. The proposed method is sensitive to 50 ng Se. The error does not exceed ± 1.5% in the concn. 50 μg - 10 μg.

268. -,-, SOLUBILITY

Matynia, Andrzej; Wierzbowska, Boguslawa; Kot, Jaroslow. Solubility in the ascorbic acid - methanol-water system. Chem. Stosow. 1987, 31(2), 249-55.

Solubilities of ds. of Satd. solns. in the system ascorbic acid MeOH-H_2O were studied at 323-343 K and for 0-40% MeOH concns. under such conditions, the max. overcooling and oversatn. of the solns. attained high values. The width of the metastable region increased approx. 2-fold when the cooling rate rose from 4.17×10^{-3} to 33.3×10^{-3} degree/S.

269. ,-,-,

Apelblat, Alexander; Manzurola, Emanuel. Solubility of ascorbic, 2-furancarboxylic, glutaric, pimelic, salicylic, and O-phthalic acids in water from 279.15 to 342.15 K, and apparent molar volumes of ascorbic, glutaric and pimelic acids in water of 298.15 K. J. Chem. Thermodyn. 1989, 21(9), 1005-8

The solubilities of ascorbic, 2-furancarboxylic, glutaric, pimelic, salicyclic, and O-phthalic acids in water from 279.15 to 342.15 K and the apparent molar volumes of ascorbic, glutaric, and pimelic acids in water at 298.15 K were detd.

270. -, ETHANOL-ANALYSIS-SYSTEMS-METASTABLE

Matynia, Andrzej; Wierzbowska, Boguslawa. Metastable region in the system ascorbic acid ethanol-water. Przem. Chem. 1989, 68(2), 81-3.

The soly and d. was studied in the title system of 308-358 K and 0-40 wt% EtOH. The soly. of ascorbic acid (I) in aq. EtOH is lower than in aq. MeOH or water. The I supersatn. solns. in aq. EtOH were detd. The optimal conditions for I crystn. are specified.

PART THREE

APPENDICES

APPENDIX- A

SYMBOLS AND ABBREVIATIONS

abs.	absolute
addn.	addition
alc.	alcohol
alk.	alkali
amt.	amount
anal.	analysis
anhyd.	anhydride
aq.	aqueous
aq. solns	aqueous solution
arom.	aromatic
ASA	Ascorbic acid
assocd.	associated
biochem.	biochemical
biolog.	biology
calcd.	calculated
calcns.	calculations
chem.	chemical
chromatog.	chromatography
clin. chem.	clinical chemistry
coeff.	Coefficient
compds.	compounds
compn.	Composition
Concns.	Concentration
Cond.	Condensed/conductivity
Const.	Constant
Contg.	Containing
Crystallog.	Crystallography

Crystd.	Crystallized
Crystn.	Crystallization
decompds.	decompounds/decomposed
decompn.	decomposition
degrdn.	degradation
derivs.	derivatives
det.	determine
detd.	detected/determined
detn.	determination
dil.	dilute
dissoln.	dissolution
electrochem.	electrochemical
equiv.	equivalent
esp.	especially
estd.	estimated
estn.	estimation
examd.	examined
exptl.	experimental
expts.	experiments
extn.	extracted
exts.	experimentation/extension
ferm.	fermentation
geol.	geological
Inst.	Institute
liq.	liquid
liq. chromatogr.	liquid chromatography
max.	maximum
min.	minutes/minimum

mixt.	mixture
mol. wts.	molecular weights
mol.	molecule
neg.	negative
obsd.	observed
org. solvents	organic solvents
Pathol.	Pathology
Photochem.	Photochemistry
Photoelec.	Photoelectronic
Photog.	Photography
Polarog.	Polarography
Polymn.	Polymerization
Pos.	Positive
PPn.	Preparation
pptn.	precipitation
preconc.	preconcentration
prepd.	prepared
prepg.	preparing
prepns.	preparations
qual.	quality/qualitative
quant.	quantity/quantitative
redn.	reduction
ref.	reference
resp.	respectively
Satd.	saturated
satd. soln.	saturated solution
sepd.	Separated
Sepn.	Separation

Soly.	Solubility
Soln.	Solution
Std.	Standard
Str.	Structure
tech.	technique
temp.	temperature
tert.	tertiary
thermodn.	thermodynamics
thermomech.	thermomechnics
titrns.	titrations
Vs.	Versus
wk.	week

APPENDIX - B

Author - Subject and Title Index

		Entry No.
Abe, Katsuo		232
Abushanab,Elic	See Saibaba, Racha	237
Acerete, Carmen		223
Ackermann, Gerhard	See Koch,Siegfried	217
Action of ascorbic acid on primary armines and -amino acids		213
Adithan, C.	See Shashindram, C.H.	90
ADSORPTION-PROPERTIES-SILICAA		1
Adsorption property of niobium(V) oxide grafted on silica gel surface		1
After chrome dyeing of wool.		36
Ahmad, Mahmood	See Hussain, Zahid	212
Ahmad, Nasir		37
Al-Ashmawi, M.I.		204
Aldaz, Antonio	See Valls, Maria J.	65,147,223
Aleo, Joseph J.		83
Alexander, P.W.		167
Al-Hakim, Ali, H.		233
ALKYLATION-KETONES, ME-TREATMENT		2
Al-Shukrawi, H.	See Poczynajlo, A.	112
Amalraj, M.	See Datta, Arabinda	114
1Amino-4 hydroxyanthraquinone as redox fluorescent indicator		243
Amperometric titration employing by hydrodynamic modulation for end point detection		253
Analysis of Vitamin C by high pressure liquid chromatography		35

Anderson, James E. See Robinson,David 95

Andrews, Glenn, C. 20

ANIMALS-TISSUES-CHANGES-DISTRIBUTION 3

+RATS SYNTHESIS 4

An anion selective polymer coating for carbon Fiber microelectodes 168

Apelblat, Alexander 99, 269

Application of Carbon-13 NMR Spectroscopy to the elucidation of the electrochemical oxidation mechanism of the L-ascorbic acid D-araboascorbic acids. 223

Application of differential pulse polarography to the study of some aspects of the oxidation of L and D isomers of ascorbic acid 79

Application of the Iron (III)-resacetophenone oximate complex for the determination of microamounts of ascorbic acid. 205

Application of the SPS method to organic electrochemistry. IX. Reaction profiles of an iron redox couple in corporated into platinum Nafion with ascorbic acid. 78

Applications of liquid anion exchanges for the Separation of Zirconium and hafnium. 221

Aqueous thermal polymerization of acrylonitrite initiated by the peroxomonosulphate ascorbic acid region system 169

Archer, Alan W. 33

Arnold, R. See Fodor, G. 82

Arrigoni, O. See DeGara, L. 150,247

Arrigoni, Oreste See Tommasi, Franca 163

Arunagiri, R. See Sulochana, G. 50

Asensio Martin, A. See Devillena Rueda, F.J. Manuel 107

Ascorbate oxidase activity in rice shoot apexes during panicle initiation 159

Ascorbic acid dehydroascrobic acids measured in plasma preserved with dithiothreitol or metaphosphoric acid. 96

Ascorbic acid : a Jaffeinterference. 215

Ascorbic acid adsorption in humans : a comparison among several dosage forms. 92

Ascorbic acid and reduced glutathione concentration of human fetal tissues in relation to gestational age, fetal size and maternal nutritional status 250

Ascorbic acid and related compounds. 25

Ascorbic acid as a factor controlling its biosynthetic pathway in vivo. 247

Ascorbic acid as a Michael donor part-II. Reaction with alicylic enones. 13

Ascorbic acid as a Michael donor part II.Reaction with alicylic enones. 14

Ascorbic acid contents in plants of the centrospermatophyta and Teichiospermatophyta. 161

Ascorbic acid contents in plants of the krinophyta 162

Ascorbic acid effect on pericycle cell line in Allium Cepa root. 150

Ascorbic acid in pollen : Conversion of L-galactono-1,4-lactone to L-ascorbic acid by Lilium tongiflorium 227

The ascorbic acid system in Cuscuta reflex Roxb. 163

Ascorbic acid with cupric ions as chemotherapy for human lung tumor xenografts implanted beneath the renal capsule of immunocompetent mice. 91

Asker, A.F. 225

Assay of ascorbic acid in human crevicular fluid from clinically healthy gingival sitew by high performance liquid chromatography. 29

Assessment of ascorbic acid status as revealed by lingual test. 90

Atomic absorption spectrometric studies of the atomization of boron from a carbon rod atomizor. 196

Avigliano, Luciana See D'Andrea,Gabriele 106

Awad, Laila 239

Baecker, T. See Hoeweler, U. 188

Bajpai, U.D.N. 87, 179

Baker, Rodney C. See Deitrich,Richard A. 183

Baker, Warren L. 17

Ban, Yoshio See Oda, Kuniyuki 80

Banwart, Steven See Dossantos Afonso, Maria 104

Baur, John E. 168

Baylocq, D. 213

Bechtold, Zdzislaw See Matynia, Andrzej 47

Bedukadze, L.I. See Gakhokidze, R.A. 86

Behaviour of membrane graphite electrodes in potentiometric titrations of reducing substances with bromine in acetic acid. 256

Bellio, J.P. See Galan, P. 5

Belter, Randolph K. See Poss, A.J. 2,242

Bensch, Klaus G. See Fleming, James E. 141

Bernstein, Jerome D. See Olson, John M. 156

Bharaj, Bhupinder Singh See Zalani, Sunita 250

Bhardwaj, Chhaya See Taqvi Khan, Mirza M. 157

Bhavannarayana, K. See Mehta, P.M. 185

Biamperometric determination of copper, silver and gold with ascorbic acid. 254

Bicyclic ring formation is not necessary for the out-oxidation of ascorbic acid. 141

Birch, Brian J. See Wring Stephen A. 71,111

Bitonti, M.B. See Arrigoni, O. 150

Blesa, Miguel A. See Dossantos Afonso, Maria 104

Blokhara, R.L. 100

BLOOD-TRANSFUSSION-DETERMINATION OF 5

Bludeau, Pequita See Deitrich, Richard 183

Boghai, D.M. See Tajnir-Riah, H.A. 160

Boku, Keiko See Kimura, Masaru 11

Borchert, Clemens 23

Borisevich, S.N. 258

Bose, Sameer See Verma,Krishan K. 255

Brain ascorbic acid levels : mice and rats selected for differences in acute reactions to ethanol. 183

Breier, A. 136

Bromometric method for simultaneous determination of iodides and ascorbic acid 258

Brown, Kathlynn C. See Doyle,Michael P. 216

Bruntlett, Craig S. See Sternitzke, Kent 75

BUFFER-SOLUTION-MECHANISM OF 6

Bui, Nguven, Maittuong 25

Burger, Nicoletta 105

Butterick, J. See Fodor, G. 82

Byrne, J.P. See Gilchrist, G.F.R 191,192

Cabrera, F. 102

Cai, Qihua 56

The C-alkalation of ascorbic acid 2

C-Allylation of L-ascorbic acid under palladium (O) catalysis 12

Campanella, L. 265

Castelli, A. See Mordente, A. 117

Castillo, F.J. See Celardin, F. 125

CATALYSIS

CACOTHELINE-DETECTION DETERMINATION OF 7

ACOOTHELINE-ESTIMATION 8

ELECTRODES-COMPARISON 9

OXIDATION-DEFICIENCY 10

OXIDATION-KINETIC 11

PALLADIUM-ALLYLATION OF 12

REACTIONS-ALICYLIC-ENONES 13

REACTIONS-ALICYLIC-ENONES 14

REACTIONS-DETERMINATION OF 15

REACTIONS, OXIDATION-EFFECT OF 16

REACTIONS, OXIDATION-ESSTIMATION 17

Celardin, F. 125

Cha, Guangli See Dong, Shaujun 73

Chahl, Loris A. See Johnston, P.A. 228

Chakrabarti, C.L. See Gilchrist, G.F.R. 191,192

Chandak, Anubha See Verma, Mahadevi 133

CHANGES,BIOCHEMICAL-VITAMINE E-DEFICIENCY-EFFECT OF 18

Changes in ascorbic acid contents in Raphanus sativus seedlings during growth and storage 41

Charykov, A.K. 97

Chatterjee, I.B. See Nandi, Anuradha 240

Che,Guangchun, Jilin See Xie Yuanwu 190

Chemical and electrochemical modification of the glassy carbon surface with quinhydrone 120

CHEMICAL COMPOUNDS-PROPERTIES, REDOX EFFECT OF 19

The chemistry of L-ascorbic anc D-isoascorbic acids. 3. Effecient synthesis of pure R- and S-1,2-0 isopropylidene-1,2,4-butanetriols 237

CHEMISTRY-ORGANIC-DERIVATIZATION-ADVANCES 20

Chen, Lind H. 18

Chen, Wei See Zhang, Fa 93

Cheng, H.Y. See Falat, Ladislav 60

Chiericato, Glatco Jr. See Sawyer,Donald T. 148

Chiral ∝-hydroxy-a and ∝-β-dihydroxy-aldehydes from D-isoascrobic and L-ascorbic acids. Useful precursors for the synthesis of fatty acid metabolites. 226

CHLOROBROMINE-B-OXIDIMETRIC TITRANT-ANALYSIS 21

CHROMATOGRAPHY

AMPEROMETRY 22

DETECTION-DETERMINATION OF 23

METHODS-ACIDS-ORGANIC-DETERMINATION OF 24

METHODS-COMPOUNDS 25

METHODS-DETERMINATION OF 26

METHODS-VARIANTS-ANALYSIS 27

OXIDATION-POLAROGRAMS 28

PAPER FLUIDS, CREVICULAR-PLASMA-HUMAN 29

PRECONCENTRATION-ANALYSIS 30

REACTIONS LIQUID-ELECTROCHEMICAL 31

SEPARATION 32

SOLUTIONS, AQUEOUS-ANALYSIS 33

TEMPERATURES, SOLVENT PERFORMANCE 34

VITAMINS-ANALYSIS 35

WOOL-TREATMENT 36

Chronic treatment with ascorbic acid inhibits the morphine with drawl response in guinea pigs. 228

Chung, Clara See Liao, Ming Long 231

Ciambra, Charles M. See Karp, Stewart 31

Ciappellano, S. See Porrini, Marisa 88

Ciric, I. See Pastor, T.J. 76

Clavilier, Jean See Valls, Maria J. 65

Climent, Miguel A. See Valls, Maria J. 65

COBALT-ANALYSIS-PFEIFFER EFFECT 37

Colina, Ramon See Eberhardt, Manfred K. 146

Comparative s tudy of ruthenium, rhodium and palladium as chemical modifiers in graphic furnace atomic absorption, spectrometry 195

Comparison of ascorbic acid and related compounds as interference suppressors in electrothermal atomic absorption spectrometry 193

COMPOUNDS-ACETATES-PMR, STUDY OF 38

COMPOUNDS-HYDROXY-REAGENT, USE OF 39

Concentration gradients for HVA, 5-HIAA, ascorbic acid, and uric acid in cerebrospinal flued 266

Concentration of ascorbic acid in different tissues of bovine fetuses in 3 different phases of development 3

Concentration-step amperometric sensor of L-ascorbic acid using cucumber juice 22

Condensation of derivatives of D-glucose with 5-O-acetyl-6-bromo-6-deoxy L-ascorbic acid 86

CONTENTS-SEEDLINGS-GROWTH-CHILLING STRESS-EFFECT OF 40

CONTENTS-SEEDLINGS-GROWTH-RAPHANUS SATIVUS
CHANGES IN 41
Continuous determination of molybdenum (VI) and iron (III) with iodide ion-selective electrode 56
Cooper, Lynne See Baker, Warren L. 17
Coulometric generation of hydrogen ions by anodic oxidation of esters of gallic acid, phenols and ascorbic acid in propylene carbonate 118
Coustard, J.M. 32
Cozza, R. See Arrigoni, O. 150
Cramer, Friedrich See Sekiue, Mitsuo 229
Crawford, Thomas See Andrews, Gleen C. 20
CRYSTALLIZATION-SOLUTIONS, AQUEOUS EFFECT OF 42
CRYSTALLIZATION-WATER SYSTEM ISOPROPANOL 43
Crystallization study in the ascorbic acid isoproponal water system 43
CRYSTALLOGRAPHY
ION'S EXCHANGE-ROLE OF 44
REACTIONS-FORMATION 45
SOLUTIONS - FORMATION 46
SOLUTIONS - METHODS 47
D'Andrea, Gabriele 106
Das, D.P. See Dash, P.C. 177
Das, N.R. 30
Dash, P.C. 177
Datta, Arabinda 114
Davanzo, C.U. See Denofre, S. 1
DeGara, Laura See Tommasi, Franca 163,247

Degrell, Istava 266

Deitrich, Richard A. 183

Denofre, S. 1

Depezay, J.C. See LeMerrer, Y. 226

DERIVATIONS - PREPARATIONS 48

Deshmukh, G.S. See Joshi, S.N. 254

Detection and determination of ascorbic acid with Cacotheline 7

Determination of ascorbic acid, hydroquinone and the thiourea by titration with copper chlorate in non aqueous medium using platinum graphite biamperometric indication. 257

Determination of ascorbic acid in multivitamin tablets by thermometric titrimetry with cerium (IV). 261

Determination of ascorbic acid in soft drinks fruit juices. Part 2. Applicability of direct ultraviolet spectrophotometry with packround correction. 220

Determination of ascorbic acid (Vitamin C) in the presence of dehydroascorbic acid using PMR spectroscopy. 204

Determination of ascorbic acid in urine. 200

Determination of ascorbic acid using as organic conducting salt electrode. 55

Determination of ascorbic acid with O-iddosebenzoate. Analysis of mixtures of ascorbic acid with methiodine and cysteine or glutathione 154

Determination of certain hydroxy compounds with the use of cerium (IV) reagent. 39

Determination of iron and cyanide in cyanoferrate complexes. 105

The determination of lead in environmental samples by slurry atomization graphite furnace atomic absorption spectrophotometry using matrix modification. 201

Determination of molybdenum by extraction of its thiocyanote into ethyl methyl ketone. 208

Determination of molybdenum by the catalyzed peroxyacetic acid-iodide-ascorbic acid reaction. 15

Determination of certain mixtures of organic compounds with N-bromosuccinimide. 255

Development of screen printed carbon electrodes, chemically modified with cobalt phthalocyanine, forelectrochemical sensor applications. 111

Devi, P. Rama 153

Devi, Y. Uma See Rajanna, K.Chinna 128

Devillena Rueda, F.J. Manuel 107

Dewald, H.D. See Wang, J. 101

Dhal, Akshaya, K. See Lenka, Subasini 181

Dhillon, B.S. See Sandhu, S.S. 85

Dhobale, A.R. See Goyal, Neelam 196

DIALYSIS ELECTRODES, GRAPHITE

A dialysis membrane-covered graphite paste electrodes as a sensor for ascorbic acid. 49

Dickson, E. Leslie 15

Diez, Ernnesto See Acerete, Carmen 223

DISEASES-ATHEROSCLEROSIS-EXCRETION SMOKING 50

Diez, Ernnesto See Ruiz, Jush, J. 147

Dong, Shaojun See Li, Fengbin 73

Dossantos Afonso,Maria 104

Doyle, Michael P. 216

Dracey, Louis See Wring, Stephen A. 111

DRUGS

REACTIONS-RATE OF 51

SUCROSE-STABILITY OF 52

TECHNIQUES-AIR SUSPENSION 53

Drungiliene, A. See Kulys, J. 64

Dubey, K.P. See Parreen, S. 182

Dumas, J. See LcMerrer, Y. 226

Dunham, Wolcott,B. See Leung, Ping Y. 91

Durisova, V. See Breier, A. 136

Durrani, M.J. See Sattar, Abdus 116

Dye - Sensitized photopolymerization : II-Photopolymerization of methyl methacrylate initiated by acrystal violet-ascorbic acid system in aqueous solution. 155

Ebdon, Les 201

Eberhardt, Manfred K. 146

Eckert-Maksic, M. See Hoeweler, U. 188

Effect of ascorbic acid on the appearance temperature of Lead in graphite furnace atomic absorption spectrometry. 191

Effect of ascorbic acid on the appearance temperature of Lead in graphite furnace atomic absorption spectroscopy. 192

Effect of ascorbic acid on the determination of heavy metals by atomic absorption spectrometry after coprecipitation with Zirconium hydroxide 194

Effect of ascorbic acid on periodontal ligament fibroblast of human deciduous and permanent teeth. 246

Effect of ascorbic acid vitamine E on biochemical changes associated with vitamin E deficiency in rats. 18

The effect of chilling stress on the content of ascorbic acid in rice seedlings. 40

Effect of growth substances on the respiratory activity in tomato fruits. 185

Effect of methonol on the crystallization of L-ascorbic acid. 42

Effect of Packaging materials and fluorescent light on HTST-pasteurized orange drink. 116

Effect of surfactant on duration of ascorbic acid synthesis. 245

Eger, Kurt 45

EiK-Nes, Kristen B. See Jakobsen, Karin 89

Ei-Shahaway, Anwar S. 77

El-Ashry, Elsayed H. See Awad, LaiLa 239
ELECTROCATALYSIS-ELECTRODES-POLYMER FILM 54
Electrocatalysis of electrodes coated with conducting polypyrole films electrocatalytic oxidation of ascorbic acid. 57
Electrocatalysis with ferrocyanide electrostatically trapped in an alkylamine siloxane polymer film on a platinum electrode. 54
Electrocatalytic oxidation of ascorbic acid at polyaniline film modified glassy carbon electrodes. 69
Electrocatalytic oxidation of ascorbic acid at a prussian Blue film modified microdisk electrode. 73
Electrocatalytic oxidation of ascorbic acid on chemically modified electrodes 64
Electrocatalytic oxidation of ascorbic acid on Prussian blue film modified electrodes. 68
Electrocatalytic oxidation of L (+)-ascorbic acid on single crystal platinum surfaces modified by irreversibly absorbed bismuth. 65
ELECTROCHEMISTRY
ELECTRODES
ADSORPTION-DETERMINATION OF 55
CATALYSIS 56
MEASUREMENTS 57
CHLOROPHYLL-MEASUREMENTS 58
DETERMINATION OF 59
DIFFERENCES-VOLTAMETRIC 60
IONS EXCHANGE CATALYSIS 61

MECHANISM 62

MICROSCOPY 63

OXIDATION 64,65,66

ANALYSIS 67

KINETICS 68

POLYANILINE FILM 69

VOLTAMETRIC 70,71

POLYPYROLE FILM-MEASUREMENTS 72

REACTIONS-OXIDATION CATALYSIS 73

TISSUES, ANIMAL 74

TREATMENTS 75

GENERATIONS-QUANTITATIVE 76

IONS EXCHANGE 77

ORGANIC REACTIONS REDOX 78

OXIDATION-PULSE-DIAGNOSIS 79

SYSTEMS-REDUCTION 80

An electron spin resonance study of organ mercury radical complexes with ortho-quinones and vitamin C. 152

Electronic spectroscopic studies of L-ascorbic acid and adenine. 77

Electronically conditive anion exchange polymers based on polypyrrole. Preparation, characterization, electrostatic binding of ferrocyanide and electrocatalysis of ascorbic acid oxidation 61

Electro oxidative catalysis using dispersal alumina on glassy carbon surfaces. 9

ELECTROPLATING-METHODS-CARBON CONTENT 81

Elmore, H. Wayne 164

El-Zaru, R.A. See Hodali, H.A. 132,135

EMBRYOLOGY-REACTIONS-DERIVATION 82

ENDOTOXIN-INHIBITION-EFFECT OF 83

Enomoto, Hidehiko See Izaki, Masanobu 81

Enthalpies of solution of malonic glutaric, ascorbic acid DL-aspartic acids in water and of fumeric acid in 0.1 mol. dm^{-3} HCl. 99

ENZYMES-MICROORGANISM-PRODUCTION OF 84

Enzymic production of ascorbic acid-2-phosphate 84

ESR-electrochemical studies of electrodes coated with conducting polypyrrole film. 72

ESR-study on quinone redical anions formed by the reaction of ascorbic acid with quinones 93

Estimation of ascorbic acid with iron(II) in acetic acid medium using cacotheline as indicator 8

Estimation of hydrogenperoxide formed and residual ascorbate in copper catalyzed oxidation reaction of ascorbate at pH 7. 17

Ethanol increase urinary and tissues ascorbic acid concentrations in rats 4

Evans, David J. 51

Extraction - spectrophotometric determination of ascorbic acid with iron(III)/1,10-phenanthroline 207

A facile removal of the arenesul formyle group by electrochemical reduction of sulfonamides in a new cooperative system of anthracene and ascorbic acid. The control of criss cross amlation. 80

Falat, Ladisiav 60

Fang, Huai See Zhang, Fa 93

Fast method for estimation of the effect of compounds modulating the radical exidation of sulfhydryl groups on 4-mercapto-2-nitrobenzoic acid applied as a model substance. 136

Feid-Allah, Hasan See Mokhtar, Hassan 234

Feliu, Juan M. See Valls, Mariya J. 65

Feng, Derong 67

Feng,Ynnshui See Feng, Derong 67

Flavin-Zirconium (4^+) ion complex as oxidation catalyst. 10

Fleming, James E. 141

Fodor, G. 82

Fodor, Gabor See Sussangkaron,Kawporn 13,14,44

Foliar ascorbic acid in some angiosperms. 249

Folkers, Gerd. See Eger, Kurt 45

Formation and characterization of 3-O-arenediazo ascorbic acids. New Stable diazoethers. 216

Fourlon, C.H. See Galan, P. 5

Franzus, Boris See Young, Jack 140

Free endogenous ascorbic acid from zygophyllaceous plants growing in the aridzone of Rajasthan 166

Freiha, Bassam A. See Wang, Joseph 253

From methyl glyoxal to new immunopotentiating ascorbic acid derivatives. 82

FRUITS-SEEDS-GROWTH 85

Fujio, Tatsuro See Maruyama, Akikiko 84

Fung, Yingsing 220

Futatsugi, Tetsuak See Sekine, Mitsuo 229

Gakhokidze, R.A. 86

Galan, P. 5

Gan, Lixian 241

Gandhi, I.S. See Shashindram, C.H. 90

Garcia Sanchez., F. See Salinas, F. 243

Garrigos, L Luis See Acerete, Carmen 223

Genestar, C. See Salinas, F. 243

George, Anne 172

George, Clifford See Sussangkaran, Kawporn 13,14,44

Ghosh, D. 187

Ghosh, Jagabandhu See Datta,Arabinda 114

Ghosh, M.N. See Shahshidran, C.H. 90

Gilchrist, G.F.R. 191 .,192

Gilliom, Richard D. See Parish, Harlie A 229

GLUCOSE-D-GLYCOSIDATION-CONDENSATION OF 86

Gomathi, H. 120

Goode, Jennifer See Baker, Warren L. 17

Goodney, David E. 35

Gowda, H. Sanker 158,184

Goyal, Neelam 196

Graft Copolymerization of ethyl acrylate on to gelation using hydrogen peroxide and ascorbic and aqueous medium 172

GRAFTING-GUARGUM-MEASUREMENTS 87

Grafting of polyacrylamide on to guargum using potassium persualfate/ascorbic acid redox system 87

Gravier-Pelletier, C. See LeMerrer, Y. 226

Green, Michael See Evans, David J. 51

Greppin, H. See Celardin, F. 125

Grote, M.

Grover, Sharda See Nag, T.N. 166

Guilleme, Joaquin See Acerete, Carmen 223

Gumargalieva, K.Z. See Myshkin, A.E. 6

Gupta, Anil K. See Verma,Krishan K. 255

Gushikem Y. See Denofre, S. 1

Haines, Alan H. See AL-Hakim, Ali H. 233

Han, Yunfu See Zhou, Ruiling 58

Han, Zhengxu See Liu, Youcheng 145

Hanif, Muhammad See Hussain, Zahid 212

Haque, Mian M.Izharul See Hussain, Zahid 212

Hardness and carbon content of an iron-electro-plate from a sulfate both containing L-ascorbic acid and citric acid. 81

Hariprasad, C.N. See Devi, P.Rama 153

Harris, C.W. See Asker, A.F. 225

Harrison, Marcia See Elmore, H.Wayne 164

Harsh, M.L. See Nag, T.N. 166

Hart, John P. See Wring, Stephen A. 71,111

Hassan, Rafat M. 219

Hata, Tsujiaki See Sekine, Mitsuo 229

Heat-stability of L-ascorbic acid in aqueous solutions. 98

Heitner, Cyril See Schmidt, John A. 151

Herrperg, S. See Galan, P. 5

Hexavalent chromium and ascorbic acid interaction on proliferation of the human cell line NHIK 3025. 89

High-performance liquid chromatographic post-column reaction system for the electrochemical detection of ascorbic acid and dehydroascorbic acid. 31

Hiller, Wolfgang See Eger, Kurt 45

Hirai, Takayuki 186

Hirami, Yoshihiko See Kawamura, Mami 16

Hirata, Goichi See Samejima, Masayoshi 113

Hodali, H.A. See El-Zaru, R.A. 132,135

Hoeweler, U. 188

Homma, Akihiko 246

Homogeneous mechanism of ascorbic acid interference in hydrogen peroxide detection of enzyme modified electrodes. 62

Hsieh, H.Steve See Hsu, Jeng M. 4

Hsu, Jeng, M. 4

Huang, Thomas T.S. See Young, Jack 140

Huang, Wenxiu See Zhong, Chuanjian 72

Hug, G. Abdul 205

Hughes, R.E. See Jones, Eleri 249

HUMAN

NUTRITION-VITAMINS-ITALY 88

PHYSIOLOGY

CELLS PROLIFERATION 89

EXPERIMENTS 90

GROWTH-INVESTIGATIONS 91

HUMUS-ADSORPTION 92

Hunahashi, Akiko See Kushibe,Mashisha 41

Hung, Tsui Hwa See Wang, Xiaoying 26

Hussain, B.H. See Sattar, Abdus 116

Hussain, Sadiq See Hussain, Zahid 212

Hussain, Zahid 212

Hutchinson,Douglas A. See Weir, Douglas 152

Ilcheva, L. See Matuszewski,Wojciech 94

Imer,Filiz 142

Inactivation of alkaline phosphataseby autoxidation of L-ascorbic acid. 117

Indra-Senan, P. See Jayasree, N. 264

Influence of cultural and physiochemical factors on ascorbate stability in plant tissue culture media. 164

Influence of Storage unertropical conditions on the stability and dissolution of ascorbic acid tablets. 225

Inhibition of ascorbic acid uptake by endotoxin : evidence for mediation by serum factor(s). 83

Inhibition action of some water soluble vitamins against catalytic oxidation of ascorbic acid. The effect of pyridoxamine and folic acid. 16

Initiation of the polymerization of acrylic acid and sodium acrylate by the redox system hydrogen peroxide ascorbic acid. 178

Innocenti, A.M. See Arrigoni, O. 150

In situ characterization of electrochemically activated glassy carbon electrodes with Scanning tunneling microscopy. 63

In Situ laser activation of glassy carbon-electrochemical detectors for liquid chromatography : demonstration of improved reversibility and detection limits. 75

Interference in determination of ammonia with the hypochlorite alkaline phenol method of Berthelot. 103

Interference of ascorbic acid with the starch iodine reaction. 165

Investigations on polymerization of vinyl chloride in microsuspension. 180

ION EXCHANGE-REACTIONS 93

Ishikawa, Yuichi See Shinkai, Seiji 10

Istratescu-Guti, Lucretia 161,162

Iwamoto, Kuzutoshi 46

Izaki, Masanobu 81

Jagannathan, N.R.		38
Jain, Alka	See Bajpai, U.D.N.	87
Jakobsen, Karin		89
Jaksic, L.	See Mihajlovie, R.	118
Janiszewski, Z.	See Poczynajlo, A.	112
Jayasree, N.		264
Jin, Duan	See MO, Jianwei	202
John, Earnest Obed	See Ahmad, Nasir	37
Johnson, A.F.	See Pemberton, D.R.	170,171
Johnston, P.A.		228
Jones, Eleri		249
Jordan, Robert B.	See Xu, Jinhuang	137,138, 218
Joseph, K. Thomas	See George, Anne	172
Joshi, S.N.		254
Kakkar, L.R.	See Madan, Usha	208
Kapitza, K.	See Meyle, J.	29
Kapoor, R.C.	See Kumbhat, Sunita	70,121
Karle, Isabella	See Sussangkoran,Kawporn	13,14
Karp, Stewart		31
Karve, Manjusha A.		221
Kawamura, Mami		16
Keller, H.E.	See Galan, P.	5
Khan, M.M. Taqui		189
Khan, P.A.	See Reddy, K.P.	159
Khan, R.N.	See Sattar, Abdus	116
Khopkar, Shripad M.	See Karve, Manjusha A.	221

Kimoto, Eiji 28

Kimura, Masaru 11

Kinetic and mechanistic aspects of reduction of lead tetracetate and acetic acid. 129

Kinetic and spectroscopic study of the formation of an intermediate ruthenium (III) ascorbate compley in the oxidation of L-ascorbic acid. 189

Kinetic determination of ascorbic acid in fruit juices and pharmaceutical preparation. 107

Kinetic features of ascorbic acid oxidase after partial deglycation. 106

Kinetic studies of the oxidation of L-ascorbic acid by the peroxydisulfate ion and of coper (II) catalysis 11

A Kinetic study of reduction of mercuric acetate by L-ascorbic acid in aqueous acetic acid. 128

Kinetics and mechanism of oxidation of L-ascorbic acid by chloropentammine cobaltate (III) in acidic media. 126

Kinetics and mechanism of selenium (IV) oxidation of ascorbic acid in aqueous perchlorate solutions. 219

Kinetics and mechanism of the oxidation of ascorbic acid by hexacyanoferrate (III) and Octacyanotungstate (V) Part I. 132

Kinetics andmechanism of the oxidation of benzenediols and ascorbic acid by bis (1,4,7-triazacyclononane) nickel (II) in aqueous perchlorate media. 119

Kinetics and mechanism of the oxidation of ascorbic acid by N-bromosuccinimide in acidic media. 133

Kinetics and mechanism of the oxidation of ascorbic acid by Copper (II). 134

Kinetics and mechanism of the oxidation of L-ascorbic acid by tris (oxaleto) cobaltate(III) in basic aqueous solution. 139

Kinetics and mechanism of the reaction of aqueous Copper (II) with ascorbic acid. 137

Kinetics and mechanism of the reaction of aqueous Copper (II) with ascorbic acid. 138

Kinetics and mechanism of the reaction of aqueous iron (III) with ascorbic acid. 218

Kinetics and oxidation mechanism of L-ascorbic acid by chloropentammine cobalt (III) ions in acetic acid and basic aqueous solutions. 222

Kinetics of ascorbic acid oxidation catalyzed by Copper (II) tyrosine complex. 130

Kinetics of oxidation of ascorbic acid by octacyano-molybdate (V) in aqueous method : a comparative study. 135

Kinetics of oxidation of L-ascorbic acid by iron (III) in presance of 2,2'-bipyridyl-application of Marcus Theory. 131

Kiniwa, Toshikazu 200

Kinoshita, Hideaki 49

Kissinger, Peter T. See Sternitzke, Kent 75

Klaus, R. 34

Klessinger, M.	See Hoeweler, U.	188
Kobayashi, Akiko	See Kimura, Masaru	11
Koch, Hans J.		235
Koch, Siegfried		207,217
Koida, Yoshiyuki	See Samejima, Masayoshi	113
Koizumi, Satoshi	See Maruyama,Akikiko	84
Kolb, E.		3
Komasawa, Isao	See Hirai, Takayuki	186
Konyaeva, V.S.	See Myshikin, A.E.	6
Korell, Ulrich		55
Koseoglu, Ayten	See Imer, Filiz	142
Kot, Jaroslow	See Matynia, Andrzej	268
Koupparis, Michael A.	See Shaltsa, Helen D.	210
Kraft, J.	See Martinez, P.	139
Kramarz, Wanda	See Wojtowicz, Anna	245
Kramer, Karl J.Liang, Yun-Teh	See Lu, PaoWen	244
Krueger, Eckhard	See Borchert, Clemens	23
Kucharska, Urszula	See Maslowska, Joanna	24
Kulkarni, A.G.	See Joshi, S.N.	254
Kulys, J.		64
Kumar, K.B.	See Reddy, K.P.	159
Kumar, S. Ashok	See Murty, N.Krishna	8
Kumari, I. Jyothsna	See Rao, N. Venkateswara	260
Kumbhat, S.		59
Kumbhat, Sunita		70,121
Kuo, Kuo, Nana		54
Kurihara, Hirondo	See Kimoto, Eiji	28

Kushibe, Masahisa		41
Kuwana, Theodore	See Zak, Jerzy	9
Labartkava, M.O.	See Gakhokidze, R.A.	86
Lechotycki, Andrzej	See Ebdon, Less	201
LeMerrer, Y.		226
Lenhoff, H.M.	See Ngo, T.T.	103
Lenka, Subasini		155,181
Lennox, R. Bruce	See Korell, Ulrich	55
Leo, Mönika	See Kolb, E.	3
Leung, Cecilia T.		227
Leung, Ping Y.		91
Li, Fengbin		68
Li, Youfen		214
Liang,YUn-Teh	See Liao, Ming Long	231
Liang, Yun-Teh S.		230
Liao, MingLong	See Wang, Xiaouing	26,231,238
Light induced yellowing of mechanical and ultra-high yield pulps. Part 1. Effect of methylation, sodium borohydride reduction and ascorbic acid on chromophore formation.		151
Lillard, Donald W.	See Lu, PaoWen	244
Lin, Jeong Long	See Robinson,David	95
Liquid chromatographic determination of L-ascorbate 2-polyphosphate in fish feeds by enzymic release of L-ascorbate.		26
Liso, Rosalia	See Tommasi, Franca	150,163, 247

Liu, Hongxian	See Zeng, Shaoxi	40
Liu, Xue Sheng	See Liang, Yun Teh S.	230
Liu, Youcheng	See Zhang, Fa	93,145
Liu, Zhengli	See Liu, Youcheng	145
Loewus, Frank A	See Leung, Cecilia T.	227
Lowry, John P.		62
Lu, Chunsu		130
Lu, Paowen		244
Luk, Shui Fai	See Fung, Ying Sing	220
Maccarrone, Mauro	See D'Andrea, Gabriele	106
Madan, Usha		208
Madrid, L.	See Cabrera, F.	102
Majcherczyk, C.	See Baylocq, D.	213
Maksic, Z.B.	See Hoeweler, U.	188
Manabe, Osamu	See Shinkai, Seiji	10
Manetovie, M.	See Mihajlovic R.	118
Manivannan, Gurusamy		169
Mansour, O.A.	See Al-Ashmawi, M.I.	204
Manzurola, Emanuel	See Apelblat, Alexander	269
Mao, Huanyu		61
Margolis, Sam A		96
Markosyan, D.E.	See Sarkisyan, V.V.	110,206
Marpaung, H.	See Alexander, P.W.	167
Marsh, Carol A.	See Doyle, Michael P.	216
Martinez, Pablo		122,126, 139,222
Martinez, Teddy	See Wang, Joseph	63

Martorana, G.E.	See Mordente, A.	117
Maruthamuthu, Pichai	See Manivannan, Gurusamy	169
Maruyama, Akikiko		84
Maslowska, Jeanna		24,108,109
Mathelier, H.	See Fodor, G.	82
Matuszewski, Wojciech		94
Matynia, Andrzej		42,47, 268,270
Mayers, Anthony R.		261
Mayersohn, Michael	See Yung, Susanna	92
McAuley A.		119
McCormick, Larry D.	See Wang, Joseph	63
McCreery, Richard L.	See Sternitzke, Kent	75,197

Means of producing crystallized vitamin C from water-methanol solutions 47

Measurement of diffusion coefficients of some indoles and ascorbic acid by flow injection analysis 95

MEASUREMENTS

- AMPEROMETRY-DETERMINATION OF 94
- DIFFUSION ANALYSIS 95
- PLASMA-ANALYSIS 96
- SOLUTIONS
  - AQUEOUS-DETERMINATION OF 97
  - AQUEOUS-HEAT STABILITY 98
  - MALONIC GLUTARIC 99
  - MULTICOMPONENT, SOLVENT 100
  - VOLUMETRIC 101

Mechanism of ascorbic acid nitrosation with nitrite ion in neutral aqueous media 6

Mehta, P.M. 185

Mesacrespo, Dora See Romero, Revuelta, Juan 27

Messerschindit, Albrecht See D'Andrea, Gabriele 106

Metal ascorbic acid-ethylenediamine/2,2'-dipyridyl mixed ligand systems potentiometric studies 182

Metastable region in the system ascorbic acid ethanol water 270

METHODS

ALUMINON-ELIMINATION-USE OF 102

BERTHELOT-PHENOL-INTERFERENCE 103

CARBOXYLATE-ANIONS-ADSORPTION-ROLE OF 104

CYNOFERRATE COMPLEXES-DETERMINATION OF 105

KINETICS DEGLYCATION 106

KINETICS-FRUITS PREPARATION 107

LEFEBVRES ALKALINE 108

LEFEBVRES-POTENTIOMETRIC 109

PHOTOCOLORIMETRIC-DETERMINATION OF 110

PHTHALOCYANINE-ELECTRODES-DEVELOPMENT OF 111

REDUCTANTS-SEPARATION-USE OF 112

SEPARATION COACERVATION ROLE OF 113

SPECTROPHOTOMETRIC-REDUCTION-DETERMINATION OF 114

X-RAY-ANALYSIS 115

Metwally, M.F. See Al-Ashmawi, M.I. 204

Meucci, E. See Mordente, A. 117

Meyle, J. 29

Michara, Yuichi

Microencapsulation of ascorbic acid by air suspension technique and formulation of tablets 53

Microgram Determination of Ascorbic Acid in pharmaceutical preparations, ruine, Blood plasma and Fruit juices. 251

Miggiano, G. See Mordente, A. 117

Mihajlovic, R. 118

Mihara, Yuichi 194

Miklean, Saul See Karp, Stewart 31

Mitomo, Shunichi See Iwamoto, Kuzutoshi 46

Miyashita, Koichi See Fleming,James E. 141

Mizoe, Toshiyuki See Ogumi, Zampachi 78

Mnatsakanyan, Sh.Ts. See Sarkisyan, V.V. 110,206

Mo, Jianuwei 202

A modified iodometric method for determination of Selenium in water. 267

Mohacsi, T. See Fodor, G. 82

Mohan, B.M. See Gowda, H. Sanker 158

Moha, D. 236,248

Mohanty, B.K. See Dash, P.C. 177

Mohanty, G.B. See Reddy, K.P. 159

Mohanty, Indu B. See Lenka, Subasini 155

Moiseev, Y.V. See Myohkin, A.E. 6

Mokhtar, Hassan 234

Morando, Pedro, J. See Dossantos Afonso,Maria 104

Mordente, A.		117
Morena-Manas, Marcial		12
Mousaad, Ahmad	See Awad, Laila	239
Mujumdar, R.	See Fodor, G.	82
Munir, Chrisly	See Ahmad, Nasir	37
Muralikrishna, U.		203,209
Murray, Roycew	See Kuo, Kuo, Nan	54
Murty, D.S.R.		199
Murty, J. Adinarayana	See Muralikrishna, U.	203,209
Murty, N. Krishna		7,8
Myshkin, A.E.		6
Nag, T.N.		166
Nagabhushanam, T.	See Reddy, G.Gangi	174,175, 176
Nagy, Erzsebet	See Degrell, Istvan	266
Naidu, G.R.K.	See Devi, P. Rama	153
Nakamachi, Hideo	See Nomura, Hiroaki	115
Nand, K.C.	See Verma, Mahadevi	133
Nandi, Anuradha		240
Nayak, M.C.	See Dash, P.C.	177
Nayak, Padma L.	See Lenka, Subasini	155
Nesloney, Carey L.	See Dyle, Michael P.	216
New aspects of the oxidation reduction mechanism of the ascorbic dehydroascorbic acid system on the dropping mercurry electrode.		147
New furo 3,2-b furans derived from L-ascorbic acid.		44

New method of determination of organic acids on chromatograms with horse radish per oxidase. 24

A new redox initiating system for the polymerization of vinyl monomers. 179

Ngo, T.T. 103

Niki, E#suo See Yamamoto, Keiji 143

Nishizawa, Makoto See Chonan, Takao 98

Nivedita, Miss See Bajpai, U.D.N. 179

Nomura, Hiroaki 115

A novel method for eliminating matrix interferences in the determination of strontium by flame atomic absorption spectrometry. 199

N-substituted Phenothiazines as redox indicators in titrations with Cerium (IV) sulfate. 158

Oda, Kuniyuki 80

Ogonski, Tadeusz 19

Ogumi, Zempachi 78

Ohnuma, Takeshi See Oda, Kuniyuki 80

Olson, John M. 156

Omi, Takashi See Tzaki, Masanobu 81

O'Neill , Robert D. See Lowry, John P. 62,66

On-line electrochemical determination of ascorbic acid. 59

ORANGE, POSTURIZED-ANALYSIS-EFFECT OF 116

Oratore, Arduino See D'Andrea, Gabriele 106

Ormonde, Dymphna E. 66

Oscillatory behaviour during the oxygen oxidation of ascorbic acid. 140

Owezarek, Alina See Maslowska, Joanna 108,109

OXIDATION

ALKALINE-EXPERIMENTS 117

ANODIC-GENERATION, COULOMETRIC 118

BENZENEDIOLS-MECHANISM 119

CATALYZE-MODIFICATIONS 120

ELECTRODES-VOLTAMETRIC 121

KINETIC

ACIDIC

CATALYSIS 122

DETERMINATION OF 123,124, 125

MECHANISM OF 126

REDUCTION 127

STUDY OF 128

TREATMENTS 129

CATALYSIS 130

MARCUSTHEORY-APPLICATION OF 131

MEASUREMENTS 132

MECHANISM OF 133,134

METHODS, AQUEOUS COMPARATIVE STUDY 135

METHODS EFFECT OF 136

REACTIONS-EFFECT OF 137

REACTIONS-MECHANISM OF 138

SOLUTIONS, AQUEOUS MECHANISM 139

Oxidation mechanism of L-ascorbic acid by hexacy anoferrate (III) is strongly acidic media 122

OXIDATION METHODS OSCILLATORY 140

Oxidation of ascorbic acid and dehydroascorbic acid by superoxidation in aportic media 148

The oxidation of ascorbic acid at carbon paste electrodes. Modified response following contact with surfactant. Lipid and brain tissue 66

OXIDATION

RATES-FORMATION 141

OXIDATION

REACTIONS

CATALYSIS-INVESTIGATION 142

IRON-ROLE OF 143

MONOBROMOACETIC ACID ANALYSIS 144

REDOX-CHARACTERISTICS 145

SOLVENT EFFECT OF 146

REDUCTION-ELECTRODES-MECHANISM OF 147

Oxidation-reduction reactions and analysis for thioureas, hydrozines and ascorbic acid in fused monobroacetic acid 144

OXIDATION

STOICHIOMETRY-CATALYSIS 148

SYSTEMS-TREATMENT 149

Oxygen-ascorbic acid-vanadyl ion initiating system. A kinetic study of the polymerization of methyl methacrylate and acrylonitrite in aqueous sulfuric acid 176

Oxygen promoted radical polymerization of acrylonitrite in aqueous nitric acid. A kinetic study 175

Padh, Harish See Aleo, Joseph J. 83

Pal, Aditya Kumar See Datta, Arabinda 114

Pande, S.P. See Sarin, R. 267

Pandey, Naresh Kumar 211

Paoletti, A.M. See Campanella, L. 265

Parish, Harlie A. 224

Parreen, S. 182

Paster, M.M. See Pastor, T.J. 256

Pastor, T.J. 76,256

Patel, B.M. See Goyal, Neelam 196

Pathak, V.N. 251

Patnaik, S. See Reddy, K.P. 159

Paule, Robert C. See Margolis, Sam A. 96

Pei, Jianbong See MO, Jianwei 202

Peisker, Silke See Koch, Siegfried 207

Pellerin, F. See Baylocq, D. 213

Pemberton, D.R. 170,171

Pentavalentvanadium-ascorbic acid redox system initiated polymerization of acrylonitrite. 177

Perez, R. See DeVillena Rveda, F.J. Manuel 107

The Pfeiffer effect studies in some mixed ligand complexes of Cobalt (III) 37

PERICYCLE CELL LINE-TREATMENT-SYNTHESIS 150

Phan, A.P.H. See Ngo, T.T. 103

Philianos, Skevos M. See Shaltsa, Helen D. 210

PHOTOCHEMISTRY

CHROMOPHORE_ADSORPTION 151

REACTIONS, THERMAL-VITAMINS 152

Photocolorimetric method for determination of silica in the presence of vanadium ions 206,110

Photometric determination of Chromium (VI) 153

PHOTOMETRY

CHROMIUM-DETERMINATION OF 153

MIXTURES-ANALYSIS-DETERMINATION OF 154

PHOTOPOLYMERIZATION-SOLUTION, AQUEOUS-EFFECT OF 155

PHOTOSYNTHESIS

BACTERIA-SOLAR-PRODUCTION 156

OXIDATION-SYSTEMS 157

REACTIONS, REDOX 158

RICE GROWTH 159

PHYSIOLOGICAL CHEMISTRY-VITAMINS-EFFECT OF 160

Pickup, Peter G.J. See Mao, Huanyu 61

Pino Alea, Jorge See Romero Revuelta,Juan 27

PLANTS

CENTROSPERMATOPHYTA-SPECIES-DETERMINATION OF 161

KRINOPHYTA-SPECIES-DETERMINATION OF 162

PARASITIC-SEEDLINGS-SYNTHESIS 163

TISSUES-FACTORS, PHYSIOCHEMICAL-INFLUENCE OF 164

TISSUES-REACTIONS-INTERFERENCE OF 165

ZYGOPHYLLACEOUS-RAJASTHAN 166

Plasma ascorbic acid determination : Is it necessary to centrifuge and to stabilize blood samples immediately in the field 5

Pleixats, Roser See Morena,Manas,Marcial 12

Poczynajlo, A. 112

Polarographic investigation of ascorbic acid oxidation 142

POLAROGRAPHY-SAMPLING-ANALYSIS 167

PoloDiez, L.M. See DeVillena Rueda, F.J. Manuel 107

POLYMER-COATING-ELECTRODES-TREATMENTS PLAMILIAN-CERBRAL-USE OF 168

POLYMERIZATION

AQUEOUS THERMAL SYSTEMS, REDOX 169

Polymerization of methyl methacrylate in the presence of molecular oxygen - A kinetic study 174

Polymerization of Vinyl acetate using visible radiation and a dye-reducing agent sensitizer. 2. Kinetic studies and polymerization mechanism 171

Polymerization of Vinyl acetate using visible radiation and a dye reducing agent sensitizer. 1. Pre-initiation and initiation reactions involving ethyleosin and ascorbic acid 170

POLYMERIZATION

REACTIONS

RADIATIONS 170,171

SYNTHESIS 172

SYSTEMS 173

KINETICS 174,175, 176,177

REDOX 178

INVESTIGATIONS 179,180

RATE OF 181

Pontikos, Nicholas, M. See Rice, Ronald J. 197

Porrini, Marisa 88

Poss, Andrew, J. 242

Potassium N-iodobenzene sulfonamide as an oxidimetric titrant in acqueous medium 263

Potentiometric and titrimetric determination of some reductants with N-bromosuccinimide 184

Potentiometric and visual ascorbinometric determination of manganese (III) 262

Potentiometric studies of mixed complexes on manganese (II) with ascorbic and tartaric acids 109

Potentiometric studies on mixed complexes of alkaline earth group metals with ascorbic acid and tartaric acid 108

POTENTIOMETRY-SYSTEMS-TECHNIQUES 182

Potluri, V.K.R. See Murly, N.Krishna 7,8

Prasad, B.B. See Ghosh, D. 187,257

Preconcentration of rare earths in geological materials with ascorbic acid for their neutron activation analysis 30

Preparation of 6-amino-6-deoxy derivatives of ascorbic and ascorbic acid 48

The preparation of some C-deuterated L-ascorbic acids. 235

Puri, J.K. 144

Qiu, Weizhong See Feng, Derong 67

Quantitative anodic generation of Cerium (IV) in acetic acid. 76

Quantitative correlations of heterogeneous electron-transfer kinetics with surface properties of glassy carbon electrodes. 197

Quay, Steven C. See Flemming, James E. 141

Rabaron, A. See Baylocq, D. 213

Radhakrishnan Ganga See George, Anne 172,236,248

Radical intermediates and antioxidant activity of ascorbic acid. 145

Ragab-Depre, Nadine J. 149

Rai, Sandeep See Bajpai, U.D.N. 87

Rai, Vinay K. See Sharma, Shanti S. 165

Rajadurai, S. See Mohan, D. 236,248

Rajalakshmi, R. See Zalani, Sunita 250

Rajanna, K.Chinna See Saiprakash, P.K. 127,128,129

Ramakrishna, K. See Rao,P.V. Subba 131

Rangaswamy See Usha, B.N. 21,263

Rao, B.V. 262

Rao,G. Prabhakara See Gomathi, H. 120

Rao, G. Venkateshwer See Saiprakash, P.K. 127,129

Rao, K. Mohana See Rao, P.V. Subba 131,259

Rao, K. Venkata See Reddy, G. Gangi 174,175,176

Rao, N. Venkateswara 259,260

Rao, P.V. Subba 131

Rao, P.V.V. Prasada See Devi, P. Rama 153

Rao, S. Brahmaji See Hug, G. Abdul 205

Rao, V. Jagannadha See Murlg, N.Krishna 7

Raoot, Sarada See Rao, B.V. 262

Rapid analysis of vitamin C by enzyme electrode. 67

Rapid flow analysis suing differential pulse polarography with automatic sampling. 167

Rapid stopped-flow volummetry with potential scanning. 101

The rate of reduction of Cis-, Cis-, Trans-bis (isopropylamine) dichlorodihydroxoplatinum, CHIR, the anti-cancer drug by ascorbic acid. 51

Rawat, C. See Kumbhat, S. 59

The reaction between nitric and ascorbic acid. 265

REACTIONS-BRAIN-DIFFERENCES 183

The reaction of Copper (I) oxygen and Copper(I-I) ascorbic acid-oxygen with dimethylsulfoxide. The effect of solvent. 146

The reaction of 1,1-dibromopinacolone with ascorbic acid. 224

Reactions of iron (III) with ethylenediamine-tetraacetic acid with enois. 217

Recent advances in the derivatization of L-ascorbic acid. 20

Reddy, G. Gangi 174,175, 176

Reddy, K.P. 159

Redox properties of compounds containing -keto-endiolic system in the molecule. 19

REDUCTANTS-TITRIMETRIC-DETERMINATION OF 184

Reduction of the thallium triacetate and manganese triacetate by L-ascorbic acid - a kinetic study. 127

The reductive dissolution of iron oxides by ascorbate : The role of carboxylate anions in accelerating reductive dissolution. 104

Refractometric determination of diacetone sorbase after extraction from technological solutions of ascorbic acid. 97

Relation between growth pattern, endogenous growth hormones and metablites in the developing fruit of Sharbati peach. 85

RESPIRATION-FRUITS-TOMATO-EFFECT OF 185

Rhythmic crystallization of ascorbic acid precipitated from its methanol solutions. 46

Rice, Ronald J. 197

Robinson, David 95

Robinson, J. Barry See Yung, Susanna 92

Rodriguez, A.F. See Martinez, Pablo 122,126, 222

Rodrianez-Mellado,Jose M. See Ruiz, Juan J. 147

Role of iron and ascorbic acid in the oxidation of methyl linoleate micelles. 143

Romero-Revuelta, Juan 27

Rosolowski, Szczesny 123

Ruiz, J.J. See Sanchez-Maestre, M. 79

Ruiz, Juan J. 147

Russell, Judy See Weir Douglas 152

Ruthenium (III) EDTA catalyzed oxidation of ascorbic acid by hydrogen peroxide in aqueous solution. 124

Saibaba, Racha 237

Saiprakash, P.K. See Rajanna, K. Chinna 127,128, 129

Saleh, H.M. See Al-Ashmawi, M.I. 204

Salinas, F. 243

Samal, R.K. See Dash, P.C. 177

Samejima, Masayoshi 113

Samples, Barbara See Elmore, H. Wayne 164

Sanchez-Maestre, M. 79

Sandhu, S.S. 85

Santappa, M. See Reddy, G. Gangi 174,175, 176

Santini, S.A. See Mordente, A. 117

Saradamba, G.V. See Rao, P.V. Subba 131

Sarin, R. 267

Sarkisyan, V.V. 110,206

Sarma, Mallela, S.P. See Saibab, Racha 237

Sastry, M.D. See Goyal, Neelam 196

Satish Kumar See Blokhara, R.L. 100

Sattar, Abdus 116

Saveleva, G.I. See Borisevich, S.N. 258

Sawyer, Donald T. 148

Scavenging of Superoxide radical by ascorbic acid. 240

Schegel, R. See Schirge, H. 180

Schirge, H. 180

Schmidt, John A. 151

Schmidt, Rainer See Eger, Kurt 45

Sefer, Tamar See Imer, Filiz 142

Seib, Paul A. See Wang, Xiaoyang 26,230, 231,238, 241,244

Sekine, Mitsuo 229

Seno, Manabu See Iwamoto, Kuzutoshi 46

Separation and purification of Vanadium and molybdenum by Solvent extraction followed by reductive stripping. 186

Separation of ascorbic acid isoascorbic acids by reversed-phase ion-pair chromatography. 32

SEPARATION-PURIFICATION-SOLVENTS-MECHANISM 186

Seshaiah, K. See Devi, P. Rama 153

Shakunthala, R. See Gowda, H. Sanker 184

Shaltsa, Helen, D. 210

Shang, Xueqin See Feng, Derong 67

Shanklin, Michael S. See Doyle, Michael P. 216

Shashindram, C.H. 90

Sharma, P. See Kumbhat, S. 59

Sharma, Sanjeev See Elmore, H. Wayne 164

Sharma, Shanti S. 165

Sharma, Shashi See Sharma, Shanti, S. 165

Sharma, Vijay See Puri, J.K. 144

Shekhawat, S.S. See Nag, T.N. 166

Shen, G.L. See Xu, F. 74

Shinkai, Seiji 10

Shukla, A.K. 53

Shukla, I.C. See Pathak, V.N. 39,251

Shukla, R.S. See Taqui, Khan, M.M. 124,189

Sikorskii, Ryszyard T. See uhniat, Maria 178

Significance of mobile phase temperature in high performance thin layer chromatography demonstrated by some practical examples. 134

Silylphosphites. 21. A new method for the synthesis of L-ascorbic acid 2-O-phosphate by utilizing phosphonyl rearrangement. 229

Simonetti, P. See Porrini, Marisa 88

Simonovic, Z. See Pastor, T.J. 256

Simple kinetic determination of trace amounts of ascorbic acid in plant extracts. 125

Simultaneous determination of ascorbic acid Saccharin, and preservatives in beer by ion-pair chromatography on RP phases and gradient elution. 23

Simultaneous enymatic determination of glucose and ascorbic acid using flow-injection amperometry. 94

Singh, A.L. See Pathak, V.N. 251

Singh, T.B. 257

Single-Sweep polarographic determination of trace nitrite in ferrous and ascorbic acid medium. 202

Slaveikova, V. See Tsalev, D. 195

Smoking and ascorbic acid (Vitamin C) excretion. 50

Solar production of hydrogen A. biological approach. 156

Solubility in the ascorbic acid-methanol-water system. 268

Solubility of ascorbic, 2-furan carboxylic, glutaric, pimelic, and O-phthalic acids in water from 279.15 to 342.15 K, and apparent molar volumes of ascorbic, glutaric and pimelic acids in water of 298.15 K. 269

Solute-Solvent interaction studies of some solutions involving Ascorbic Acid. 100

SOLVENTS-BIAMPEROMETRIC ELECTRODES USE OF 187

SOLVENTS FORMS, TAUTOMETRIC EFFECT OF 188

Some analytical applications of chlorobromamine-B. 21

Some analytical applications of N-chlorosuccinimide : direct potentiometric and visual titrations in aqueous acetic acid medium. 264

Some observations on the sodium arsenate assisted oxidation of ascorbic acid by phosphomolybdic acid. 209

Song, Fayi See Dong, Shaojun 69

Song, Qi 173

Soto, Karen See Eberhardt, Manfred K. 146

Specific differential spectrophotometric determination of ascorbic acid in plants using ascorbate oxidase 210

SPECTROCHEMISTRY-REACTIONS-OXIDATION 189

SPECTROELECTROCHEMISTRY-ELECTRODES, MICRO-TRANSMISSION 190

Spectroelectrochemistry with cylendrical carbon fiber microelectrodes 190

SPECTROMETRY

ADSORPTION

ATOMIC-EFFECT OF 191,192

COMPARISON OF 193

EFFECT OF 194

EFFICIENCY 195,196

ELECTRODES-MEASUREMENT 197

TITANIUM-EFFECT OF 198

METHODS

ABSORPTION USE OF 199

DETERMINATION OF 200

Spectrophotometric and titrimetric determinations of ascorbic acid. 211

Spectrophotometric determination of ascorbic acid in pharmaceutical preparations and fruit juices. 203

Spectrophotometric determination of Selenium at trace levels. 212

Spectrophotometric determination of tungsten by reduction with ascorbic acid. 114

Spectrophotometric study of quaternary complexes of titanium with pyrocatechol violet II. 198

Spectrophotometric study on the reaction between palladium ,B,r, -tetra-(4-di-metyl amino phenyl) prophine. 214

SPECTROPHOTOMETRY

ADSORPTION, ATOMIC DETERMINATION OF 201

ELECTRODES- DETERMINATION OF 202

FRUITS PREPARATIONS 203

METHODS

DETERMINATION OF 204,205,206

EXTRACTION 207

DETERMINATION OF 208

OXIDATION 209

MEASUREMENT 210

POTENTIOMETRIC-DETERMINATION OF 211

SELENIUM DETERMINATION OF 212

REACTIONS

AMINES-DETERMINATION OF 213

CATALYSIS 214

EFFECT OF 215

FORMATION 216

IRON 217

KINETICS-MECHANISM OF 218

OXIDATION KINETICS 219

ULTRAVIOLET JUICES DETERMINATION OF 220

SPECTROSCOPY
METHODS
IONS EXCHANGE
APPLICATION OF 221
KINETICS 222
OXIDATION-APPLICATION OF 223
REACTIONS-DIBROMOPINACOLONE 224
Spencer, Lee See McAuley, A. 119
Srinlvasan, R. See Jaganathan, N.R. 38
A Stable form of vitamin C: L-ascorbate 2-triphosphate synthesis, isolation, and properties 238
Stability of aqueous solutions of ascorbic acid prepared for analysis of high performance liquid chromatography 33
Stabilizing activity of L-ascorbic acid of 3-methoxyphenyl-2-thiohydrantion amino acid and 3-ethoxyphenyl-2-thiohydanto in amino acid 232
Stankovicova, T. See Breier, A. 136
Sternitzke, Kent 75
STORAGE CHANGES, SUBSTANTIAL INFLUENCE 225
Strope, Douglas See Sussangkarn, Kawporn 44
Stuart, Ronalds See Koch, Hans J. 235
Studies in Stability of ascorbic acid in selected sucrose based vehicles. Part II. 52
Studies on microcapsule. I. Role and effect of Coacervation including agents in the microencapsulation of ascorbic acid by a phase separation method. 113

Studies on Sensor for L-ascorbic acid using animal tissue slices. 74

Studies on the graft copolymerization of acrylonitrite onto humic acid. 173

Studies on the oxidation products of ascorbic acid III. Polarographic Studies. 28

Studies towards the synthesis of analogs of L-ascorbic acid. 233

Study of some variants of the method for ascorbic acid determination with 2,4-dinitrophenyl hydrazine. 27

Study on the chlorophyll-a/poly (Vinyl alcohol) Sandwich Solar cell. 58

Stumm, Werner See Dossantos Afronso,Maria 104

Subbaiah, K.V. See Rao, P.V. Subba 131

Subrahmanya, U. See Gowda, H. Sanker 184

Sundraud, G. See Coustard, J.M. 32

Sulochana, G. 50

Surendrajit See Nag, T.N. 166

Suskovic, Bozidar 48

Sussangkarn, Kawporn See Fodor, G. 13,14,44, 82

Suehla., Gyula See Dickson, E.Leslie 15

Synthesis and reaction of arylimino ascorbic acid amalogs. 234

SYNTHESIS

FATTY ACID-METABOLITES 226

GERMINATION EFFECT OF 227

GUINEA PIGS-TREATMENT 228

METHODS-PREPARATION 229

Synthesis of Casein-G-poly(Vinyl acetate) II. 236

Synthesis of Casein-poly (methyl acrylate) II. 248

Synthesis of D-erythroascorbic acid 230

Synthesis of L-ascorbate-6-phosphate 231

Synthesis of 3-(L-threo-glycerol-1-yl)-6,7-dimethylpyrazole 3,4-b quinoxalines 339

Synthesis of the 2-methyl ether of L-ascorbic acid: Stability, Vitamin activity, and Carbon-13 nuclear magnetic resonance spectrum compared to those of the 1- and 3-methyl ehters 244

SYNTHESIS

REACTIONS

AMINO ACIDS 230,231

ANALOG 232

CATALYSIS-PREPARATION OF 233,234, 235

EFFECT OF 236

EFFICIENCY 237

ISOLATION 238

OXIDATION 239,240

ANALYSIS 241

VITAMIN C 242

REDOX 243

RESONANCE SPECTRUM 244

SURFACTANTS EFFECT OF 245

TEETH EFFECT OF 246

VIVO-CONTROL, MEASURE 247

SYSTEMS, REDOX 248

Szepesvary, E. See Pastor, T.J. 256

Tajmir Riahi, H.A. 160

Takahashi, Mareyuki See Yamamoto, Keiji 143

Takehara, Zenichiro See Ogumi, Zempachi 78

Tanaka, Hidehiko See Kimoto, Eiji 28

Taqui Khan, Mirza M. 124,157

Taura, Hidetomo See Kimoto, Eiji 28

TAXONOMY ANGIOSPERMS 249

Taylor, Colin G. See Mayers, Anthony R. 261

Telepova, N.D. See Charykov, A.K. 97

Testolin, G. See Porrini, Marisa 88

Thacker, Richard R. See Chen, Linda H. 18

Theoretical studies of the solvent effect on the stability of the ascorbic acid tautomers. 188

Thomas, Helga 36

Tiam, Zhaowu See Zhong, Chuanjian 57,72

Tikhonova, N.B. See Charykov, A.K. 97

Tikoo, B.N. See Murty, D.S.R. 199

TISSUES + HUMAN FATAL-OBSERVATIONS 250

TITRANT

FRUITS-JUICES-METHODS-DETERMINATION OF 251

IRON-DETERMINATION OF 252

TITRATION

AMPEROMETRIC ELECTRODES 253

BIAMPEROMETRIC-DETERMINATION OF 254

COMPOUNDS, ORGANIC-DETERMINATION OF 255

INPOTENTIOMETRIC-ELECTRODES INVESTIGATIONS 256

METHODS

BIAMPEROMETRIC ELECTRODES 257

BROMOMETRIC DETERMINATION OF 258

DETERMINATION OF 259

REDOX 260

THERMOMETRIC-DETERMINATION OF 261

VOLUMETRIC DETERMINATION OF 262

OXIDIMETRIC PROCEDURES 263

POTENTIOMETRIC ACETIC ACID, AQUEOUS 264

REACTIONS, METHODS 265

Titrimetric determination of ascorbic acid with chloramine-T using oxazine dyes as indicators 259

Tiwari, Asha See Nag, T.N. 166

Toki, Chie See Kimoto, Eiji 28

Tominaga, Mamoru 193

Tommasi, Franca 163,247

TREATMENTS PATIENTS-MEDICO-PSYCHIATRIC, FLUID, CEREBROSPINAL USE OF 266

Tris(2-2'-bipyridine) ruthenium (2^+) photosensitized oxidation of ascorbic acid and hydrogen evolution on titanium dioxide. 157

Trivedi, B.M. 52

Trivedi, G.M. See Trivedi, B.M. 52

Trojanowicz, Marek See Matuszewski, Wojciech 94

Tsalev, D. 195

Tsao, Constance S. See Leung, Ping Y. 91

Tsuchiva, Tohru See Sawyer, Donald T. 148

Tsuyama, Takeshi See Kimoto, Eiji 28

Tzakou, Olga Ai See Shaltsa, Helen D. 210

Uchiyama, Shunchi 22

Uhniat, Maria 178

Umestsu, Yoshiro See Uchiyama, Shunchi 22

Umezaki, Yoshimi See Tominaga, Mamoru 193

Unexpected formation of a heterocyclic spiran in the Michael reaction of ascorbic acid with acrolein. 45

Use of ascorbic and thioglycolic acids to eliminate interference from iron in the aluminon method for determining aluminium. 102

The use of ascorbic acid for reductives Separation of plutonium from uranium 112

Use of ascorbic acid as titrant for iron determination. 252

Use of molybdate reduction with ascorbic acid for the kinetic determination of micromounts of ascorbic (V). 123

Use of platinum-graphite Diamperometric indicator in non aqueous mixed solvents : determination of Copper (I), hydraquinone and ascorbic acid using ammonium hexanitratocerate. 187

Usha, B.N. 21

Viagand, V.J. See Pastor, T.J. 76

Vajgand, V. See Mohajlovic, R. 118

Valls, Maria, J. 65

Van Eldik, R. See Martinez, P. 139

Vats, V.K. See Puri, J.K. 144

Veltri, R. See Arrigoni, O. 150

Veltri, R.W. See Fodor, G. 82

Verma, K.C. See Shukla, A.K. 53

Verma, Krishna K. 154,255

Verma, Mahadevi 133

Villarroya, Merce See Morena-Manas, Marcial 12

Vinyl Polymerization initiated by peroxydiphosphate VII. Polymerization of acrylonitrile initiated by peroxydiphosphate ascorbic acid, redox system. 181

Viraraghavan, Saroja 215

Virnich, Alfred See Thomas, Helga 36

Vitamin A, E and C nutriture of elderly people in North Italy. 88

Vitamin C in organic synthesis reaction with P-hydroxybenzyl alcohol derivatives. 242

Voelker, L. See Kolb, E. 3

Voltammetric behaviour of ascorbic acid at a graphite epoxy composite electrode chemically modified with cobalt phthalocyanine and its amperometric determination in multivitamin preparations. 71

Voltammetric Behaviour of Ascorbic Acid at the DME. 70

Voltammetric behaviour of ascorbic acid at the DME. 121

Voltammetric differentiation of ascorbic acid and dopamine at an electrochemically treated graphite epoxy electrode. 60

Wada, Yoshikazu See Nomura, Hiroaki 115

Wahren, Margrit See Kolb, E. 3

Wan, Jeffrey K.S. See Weir, Douglas 152

Wang, Joseph 63,101, 253

Wang, Xiaoying See Liao, Ming Long 26,231

Wang, Yirou See Zeng Shaoxi 40

Wang, Zhongquan See Zhong, Chuanjian 57

WATER

ANALYSIS

METHODS, IODOMETRIC-DETERMINATION OF 267

SOLUBILITY 268,269

Water disinfection with the hydrogen peroxide-ascorbic acid Copper (II) system. 149

WATER, ETHANOL ANALYSIS-SYSTEMS-METASTABLE 270

Weir, Douglas 152

West, P.R. See McAuley, A. 119

Wide-line NMR Studies on organic and biomolecules: Partix-PMR study of some acetates and related compounds 38

Wierzbowska, Boguslawa See Matynia, Andrzej 43,47, 268,270

Wojtowicz, Anna 245

Woroszylo, Leokadia See Uhniat, Maria 178

Wring, Stephen A. 71,111

Xie, Chunting See Li, Youfen 214

Xie, J.Y. See Xu, F. 74

Xie, Yuanwu 190

X-ray analysis of L-ascorbic acid 2-O-phosphate. 115

Xu, F. 74

Xu, Jinhuang 134,137, 138,218

Yam, C.F. See Ngo, T.T. 103

Yamamoto, Keiji 143

Yamauchi, Hisashi See Kimoto, Eiji 28

Yang See Lu, Chunsu 130

Yang, Renwu See Cai, Qihua 56

Yang, Yuguo See Zhou, Ruiling 58

Yaniv, Daphna, R. See Wang, Joseph 63

Yathirajan, H.H. See Usha, B.N. 21

Yathirajan, H.S. See Rangaswamy 263

Yokota, Katsushi See Mihara, Yuichi 194

Yoshida, Daisuke See Kinoshita, Hideaki 49

Young, Jack 140

Yu, R.Q. See Xu, F. 74

Yung, Susanna 92

Zajecki, Janusz See Wajtowiez, Anna 245

Zak, Jerzy 9

Zalani, Sunita 250

Zeng, Shaoxi 40

Zeng, Xuling See Zhang, Deliang 198

Zhang, Deliang 198

Zhang, Dongyan See Feng, Derong 67

Zhang, Fa 93

Zhang, M.F. See Xu, F. 74

Zhao, Xiaohua See Feng, Derong 67

Zhao, Zaofan See Mo, Jianwei 202

Zheng, Doben 252

Zheng, Ping See Song, Qi 173

Zhong, Chuanjian 57,72

Zhou, Ruiling 58

Zhou, Wanli See Feng, Derong 67

Ziegelhoeffer, A. See Bräier, A. 136

Ziegler, Regina G. See Margolis, Sam A. 96

Zimmerman, Werner See Eger, Kurt 45

A zinc dyes as redox indicators in titrations with N-bromosuccinimide. 260

Zuluaga, J. See Martinez, Pablo 122,126, 139,222